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National Air Quality and Emission Trends Report, 1982

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Research Triangle Park, NC

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16. ABSTRACT

This report presents national and regional trends in air quality from 1975 through 1982 for total suspended particulate, sulfur dioxide, carbon monoxide, nitrogen dioxide, ozone and lead. Both national and regional trends in each of the major pollutants are examined and, where appropriate, specific Statewide air quality trends. Air quality trends are also presented for both the National Air Monitoring Sites (NAMS) and other site categories.

In addition to ambient air quality, trends are also presented for annual nationwide emissions. These emissions are estimated using the best available engineering calculations; the ambient levels presented are averages of direct measurements.

This report also includes a section, Air Quality Levels in Standard Metropolitan Statistical Areas (SMSA's). Its purpose is to provide interested members of the air pollution control community, the private sector and the general public with greatly simplified air pollution information. Air quality statistics are presented for each of the pollutants for all SMSA's with populations exceeding 500,000 for the years 1980, 1981 and 1982.

17. KEY WORDS AND DOCUMENT ANALYSIS

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Air Pollution Trends Emission Trends Carbon Monoxide Nitrogen Dioxide Ozone Sulfur Dioxide Total Suspended Particulates Air Pollution Standard Metropolitan Statistical ARea (SMSA) Air Quality Statistics National Air Monitoring Stations (NAMS)		

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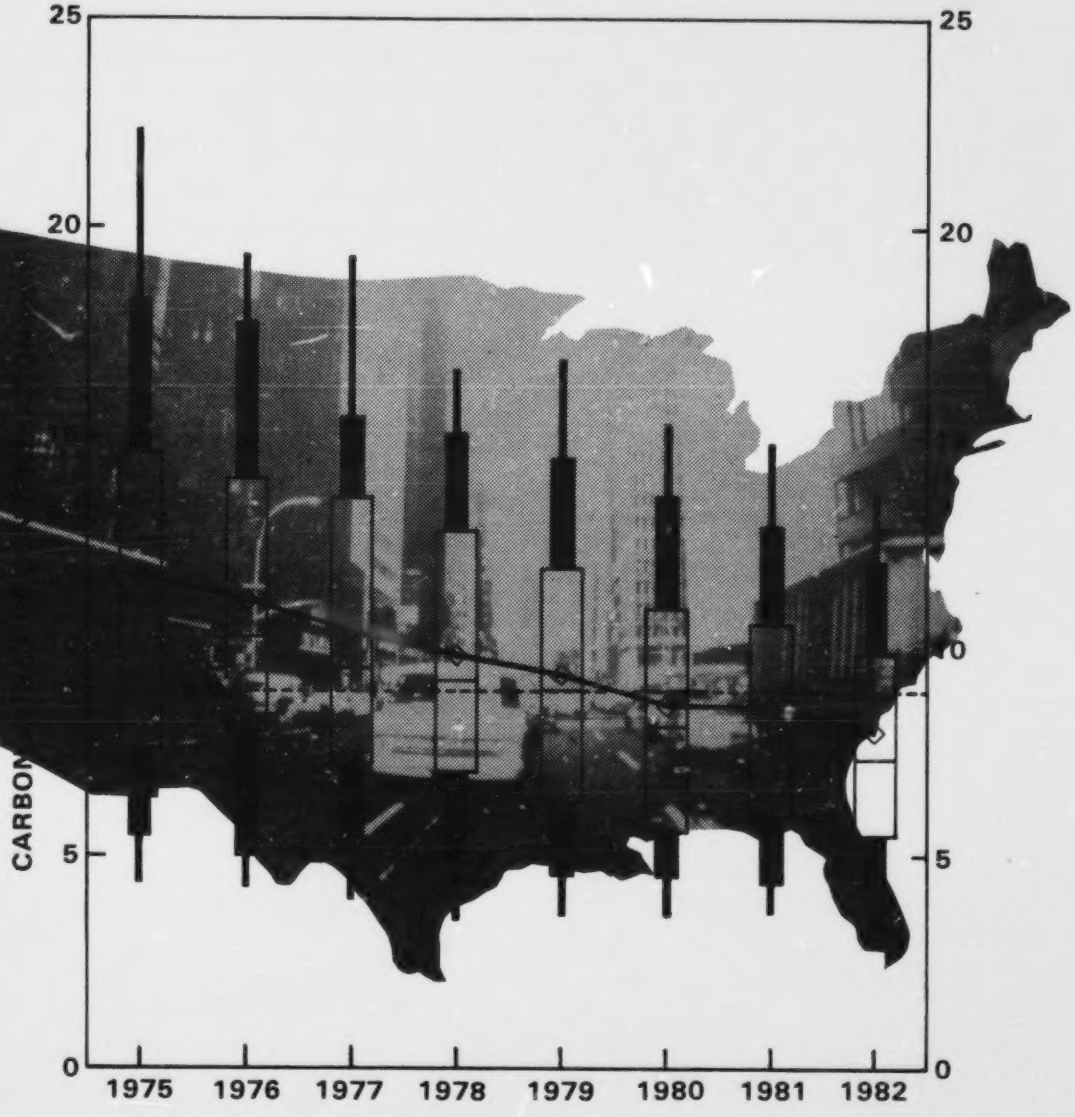

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NATIONAL AIR QUALITY AND EMISSION TRENDS REPORT, 1982

U.S. Environmental Protection Agency
Office of Air and Radiation
Office of Air Quality Planning and Standards
Research Triangle Park, North Carolina 27711

March 1984

DISCLAIMER

This report has been reviewed by the Office of Air Quality Planning and Standards, Environmental Protection Agency, and approved for publication. Mention of trade names or commercial products is not intended to constitute endorsement or recommendation for use.

PREFACE

This is the tenth annual report of air pollution trends issued by the Monitoring and Data Analysis Division of the U. S. Environmental Protection Agency. The report is directed toward both the technical air pollution audience and the interested general public. The Division solicits comments on this report and welcomes suggestions on our trend techniques, interpretations, conclusions, and methods of presentation. Please forward any response to William F. Hunt, Jr., (MD-14) U. S. Environmental Protection Agency, Monitoring and Data Analysis Division, Research Triangle Park, N. C. 27711.

The Monitoring and Data Analysis Division would like to acknowledge William F. Hunt, Jr., for the overall management, coordination, and direction given in assembling this report. Special mention should also be given to Helen Hinton for typing the report and Alison Pollack, Systems Applications, Incorporated for the calculation of confidence intervals and the preparation of graphics.

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Section 3 - Thomas C. Curran, Robert B. Faoro, and Neil H. Frank
Section 4 - William F. Hunt, Jr. and Robert B. Faoro

Also deserving special thanks are Edward Mask for assembling the air quality data base and Chuck Mann for the emission trend analyses.

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NATIONAL AIR QUALITY AND EMISSIONS TRENDS REPORT, 1982

EXECUTIVE SUMMARY

NATIONAL AIR QUALITY AND EMISSIONS TRENDS REPORT, 1982

1. EXECUTIVE SUMMARY

1.1 INTRODUCTION

National long-term (1975 through 1982) improvements can be seen for sulfur dioxide (SO_2), carbon monoxide (CO), and lead (Pb). Similar improvements have been documented in earlier air quality trends reports,[1-9] issued by the U. S. Environmental Protection Agency (EPA). Improvements can also be seen for ozone (O_3) and nitrogen dioxide (NO_2) in the period 1979 through 1982 and for total suspended particulate (TSP) between 1978 and 1982.

The trend in O_3 is complicated by a major drop in measured concentration levels which occurred between 1978 and 1979, largely due to a change in the O_3 measurement calibration procedure.[10] Therefore, special attention is given to the 1979 through 1982 period, because the change in the calibration procedure is not an influence during this period.

The trend in TSP is complicated by the fact that the glass fiber filters used to collect TSP data were changed in 1978, 1979, and again in 1982. Although the filters used in 1978 and 1982 were comparable, the filters used during 1979, 1980, and 1981 were different.[11] Therefore, special attention is given to the trend from 1978 to 1982, with less credence given to the intervening years.

In the ambient air quality trend analyses which follow, the National Air Monitoring Sites (NAMS) are compared with all the air monitoring sites meeting trends criteria. The NAMS provide accurate and timely data to EPA from a stream-lined, high quality, more cost-effective, national air monitoring network. They are located in areas with high pollutant concentrations, high population exposure, or a combination of both. Because the NAMS are located in the more heavily polluted areas, the pollutant-specific trend lines for the NAMS are higher than the trend lines for all the trend sites taken together. In general, the rates of improvement observed at the NAMS are very similar to the rates of improvement observed at all the trend sites.

All of the ambient air quality trend analyses, which follow, are based on monitoring sites which recorded at least 6 of the 8 years of data in the period 1975 to 1982. Each year had to satisfy an annual data completeness criteria, which is discussed in Section 2.1, Data Base.

1.2 MAJOR FINDINGS

Total Suspended Particulate (TSP) - Annual average TSP levels measured at 1768 sites decreased 15 percent between 1975 and 1982 (Figure 1-1). This corresponds to a 27 percent decrease in estimated TSP emissions for the same period (Figure 1-2). TSP air quality levels generally do not improve in direct proportion to estimated emissions reductions, because air quality levels are influenced by factors such as natural dust, reintrained street dust, construction activity, etc, which are not included in the emissions estimates. Since 1977, the glass filters used throughout the nation at TSP monitoring sites have been centrally procured by EPA for the State and local agencies in order to obtain uniformity in TSP collection nationwide at reduced cost. The filters used in 1979, 1980 and 1981 were found to record higher values than the filters used in 1978 and 1982, because of higher filter alkalinity, which is related to artifact error.[11] The filters used in 1978 and 1982 were supplied by the same manufacturer and found to be comparable based on similar alkalinity levels. Therefore, although the air quality values for 1979, 1980 and 1981 are probably biased high, the trend between 1978 and 1982 is valid. The air quality improvement between 1978 and 1982 is due not only to reductions in TSP emissions, but also to more favorable meteorology in 1982. An analysis of meteorological conditions for 1982 indicated a potential for lower TSP concentrations due to abnormally high precipitation.

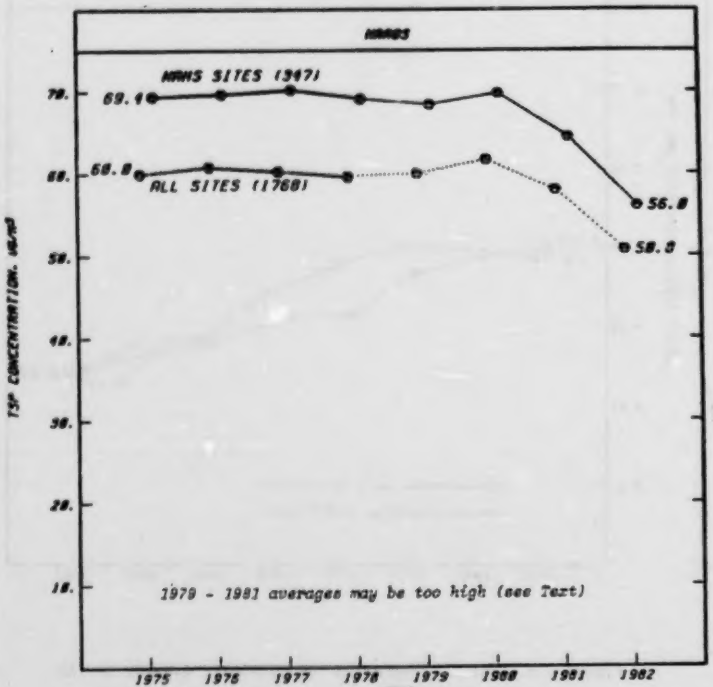

FIGURE 1-1. NATIONAL TREND IN THE COMPOSITE AVERAGE OF THE GEOMETRIC MEAN TOTAL SUSPENDED PARTICULATE AT BOTH NAMS AND ALL SITES, 1975 -1982.

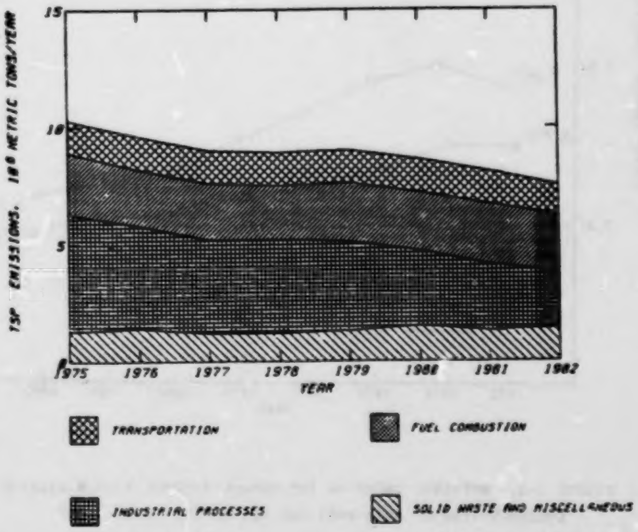

FIGURE 1-2. NATIONAL TREND IN PARTICULATE EMISSIONS, 1975-1982.

Sulfur Dioxide (SO_2) - Annual average SO_2 levels measured at 351 sites with continuous SO_2 monitors decreased 33 percent from 1975 to 1982 (Figure 1-3). A comparable decrease of 39 percent was observed in the trend in the composite average of the second maximum 24-hour averages (Figure 1-4). An even greater improvement was observed in the estimated number of exceedances of the 24-hour standard, which decreased 91 percent (Figure 1-5). Correspondingly, there was a 17 percent drop in sulfur oxide emissions (Figure 1-6). The difference between emissions and air quality trends arises because the use of high sulfur fuels was shifted from power plants in urban areas, where most of the monitors are, to power plants in rural areas which have fewer monitors. Further, the residential and commercial areas, where the monitors are located, have shown sulfur oxide emission decreases comparable to SO_2 air quality improvements. These decreases in sulfur oxide emissions are due to a combination of energy conservation measures and the use of cleaner fuels in the residential and commercial areas.

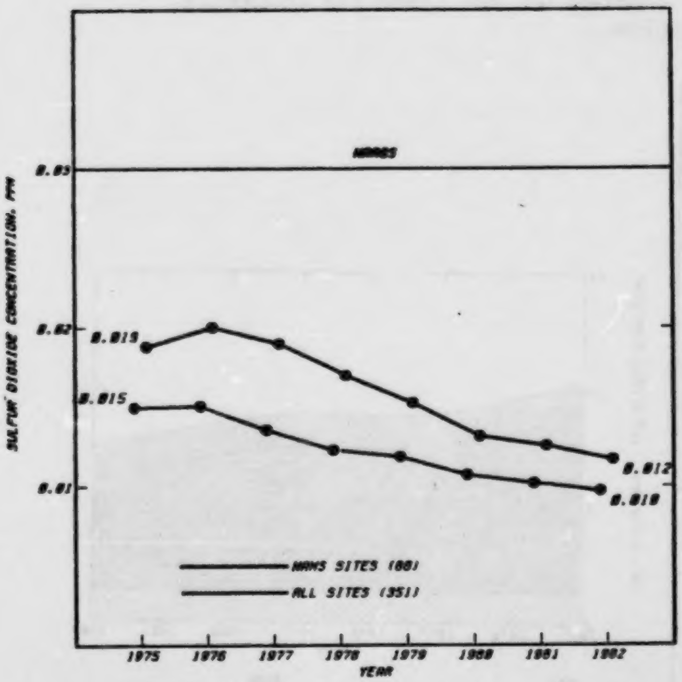

FIGURE 1-3. NATIONAL TREND IN THE ANNUAL AVERAGE SULFUR DIOXIDE CONCENTRATION AT BOTH NAMS AND ALL SITES. 1975 - 1982.

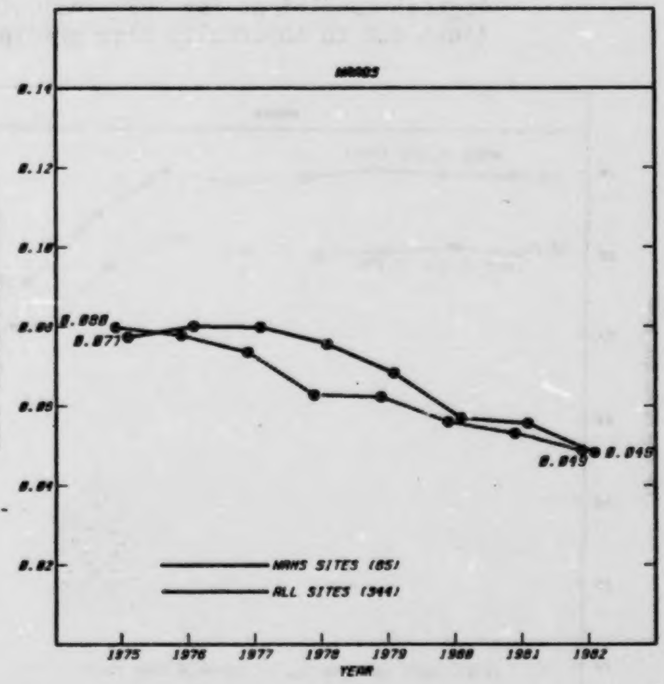

FIGURE 1-4. NATIONAL TREND IN THE COMPOSITE AVERAGE OF THE SECOND-HIGHEST 24-HOUR SULFUR DIOXIDE CONCENTRATION AT BOTH NAMS AND ALL SITES. 1975 - 1982.

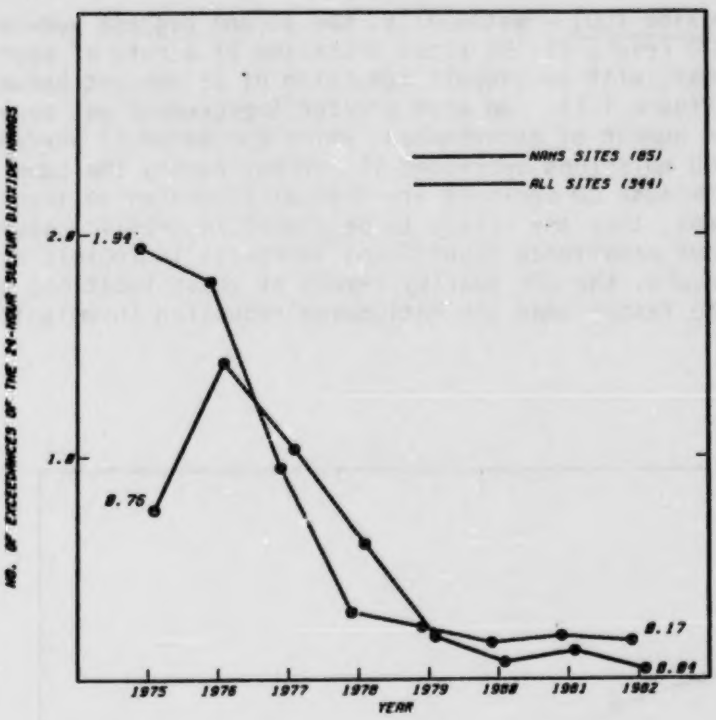

FIGURE 1-5. NATIONAL TREND IN THE COMPOSITE AVERAGE OF THE ESTIMATED NUMBER OF EXCEEDANCES OF THE 24-HOUR SULFUR DIOXIDE NAAQS AT BOTH NAMS AND ALL SITES. 1975 - 1982.

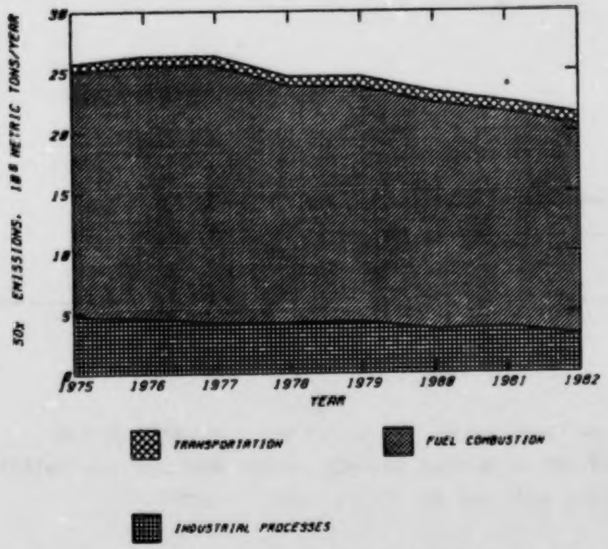

FIGURE 1-6. NATIONAL TREND IN SULFUR OXIDE EMISSIONS. 1975-1982.

Carbon Monoxide (CO) - Nationally, the second highest non-overlapping 8-hour average CO levels at 196 sites decreased at a rate of approximately 5 percent per year, with an overall reduction of 31 percent between 1975 and 1982 (Figure 1-7). An even greater improvement was observed in the estimated number of exceedances, which decreased 87 percent (Figure 1-8). CO emissions decreased 11 percent during the same period (Figure 1-9). Because CO monitors are typically located to identify potential problems, they are likely to be placed in traffic saturated areas that may not experience significant increases in vehicle miles of travel. As a result, the air quality levels at these locations generally improve at a rate faster than the nationwide reduction in emissions.

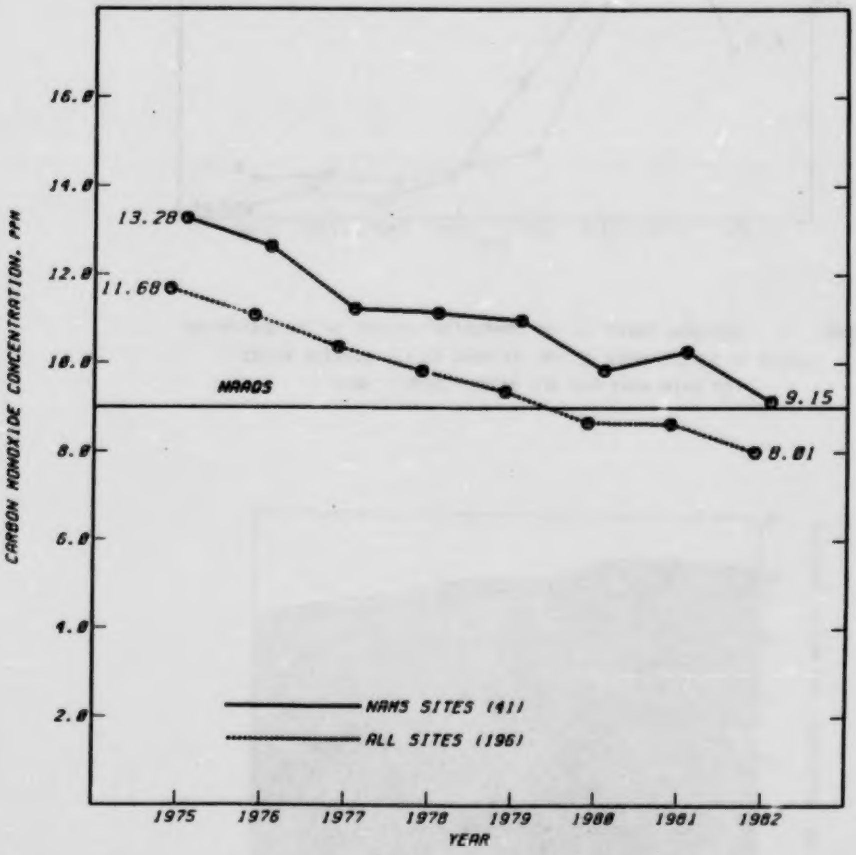

FIGURE 1-7. NATIONAL TREND IN THE COMPOSITE AVERAGE OF THE SECOND HIGHEST NONOVERLAPPING 8-HOUR AVERAGE CARBON MONOXIDE CONCENTRATION AT BOTH NAMS AND ALL SITES, 1975 - 1982.

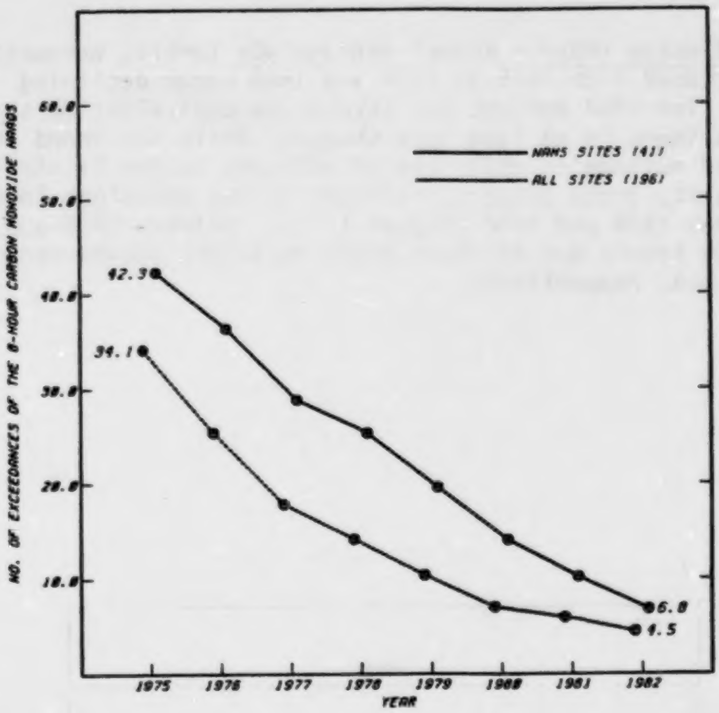

FIGURE 1-8. NATIONAL TREND IN THE COMPOSITE AVERAGE OF THE ESTIMATED NUMBER OF EXCEEDANCES OF THE 8-HOUR CARBON MONOXIDE NAAQS AT BOTH NAMS AND ALL SITES, 1975 - 1982.

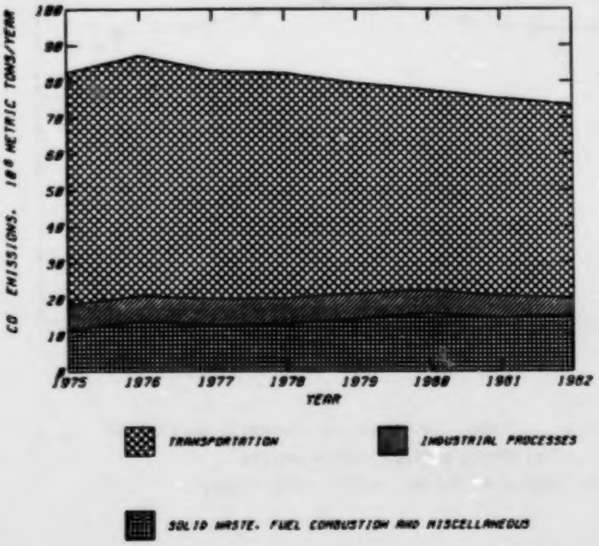

FIGURE 1-9. NATIONAL TREND IN EMISSIONS OF CARBON MONOXIDE, 1975-1982.

Nitrogen Dioxide (NO_2) - Annual average NO_2 levels, measured at 276 sites, increased from 1975 to 1979 and then began declining (Figure 1-10). The 1982 ambient NO_2 levels are equivalent to the 1975 levels, so that there is no long-term change. While the trend pattern in the estimated nationwide emissions of nitrogen oxides is similar to the NO_2 air quality trend pattern, nitrogen oxides emissions increased 5 percent between 1975 and 1982 (Figure 1-11). Between 1979 and 1982 both ambient NO_2 levels and nitrogen oxide emissions showed reductions of 7 and 5 percent, respectively.

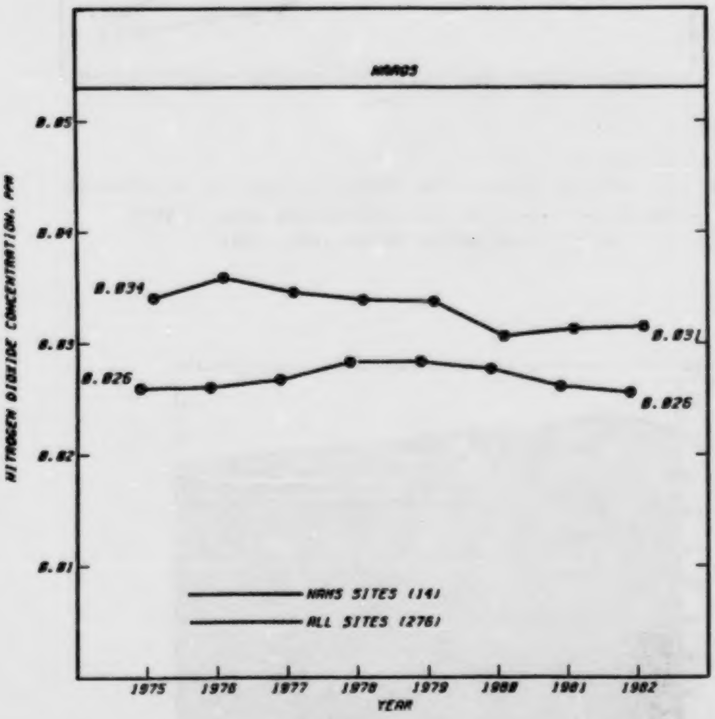

FIGURE 1-10. NATIONAL TREND IN THE COMPOSITE AVERAGE OF NITROGEN DIOXIDE CONCENTRATION AT BOTH NAMS AND ALL SITES. 1975 - 1982.

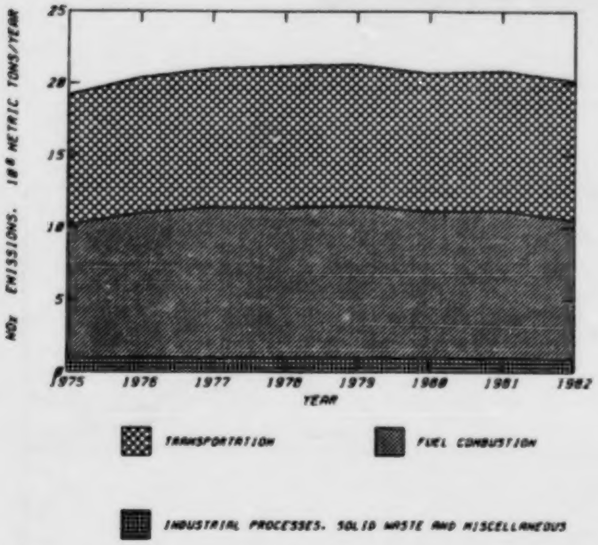

FIGURE 1-11. NATIONAL TREND IN EMISSIONS OF NITROGEN OXIDES.-1975-1982.

Ozone (O_3) - Nationally, the composite average of the second-highest daily maximum 1-hour O_3 values, recorded at 193 sites, decreased 18 percent between 1975 and 1982 (Figure 1-12). An even greater improvement was observed in the estimated number of exceedances in the ozone season (July-September), which decreased 49 percent (Figure 1-13). Volatile organic compound (VOC) emissions decreased 13 percent during the same time period (Figure 1-14). The greater improvement observed in ozone levels than emissions may be due, in part, to the non-linear relationship between VOC emissions and ambient ozone levels, and also the change in the calibration procedure which took place between 1978 and 1979. To eliminate the influence of the calibration change, trends were examined for the 1979-1982 time period. Ozone levels improved by 9 percent from 1979 to 1982, a period which was not influenced by the calibration change.

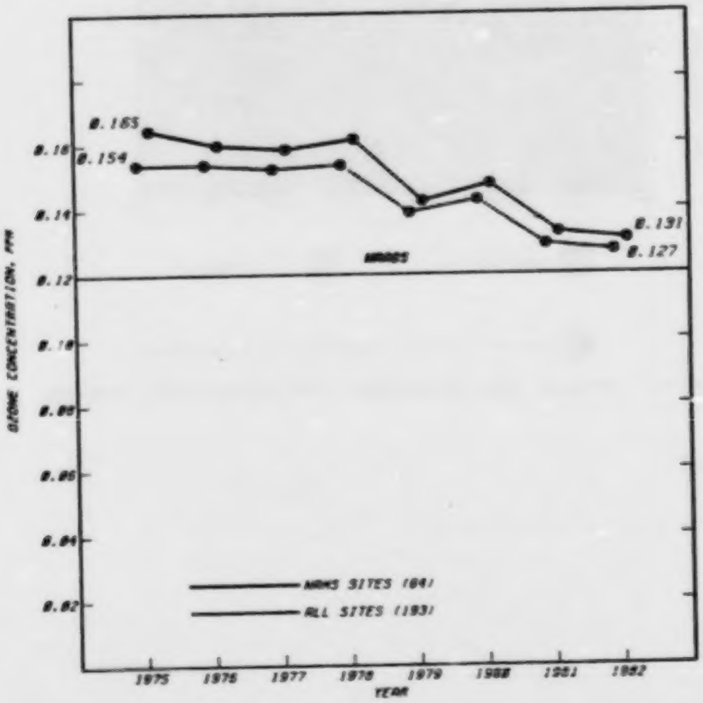

FIGURE 1-12. NATIONAL TREND IN THE COMPOSITE AVERAGE OF THE SECOND HIGHEST DAILY MAXIMUM 1-HOUR OZONE CONCENTRATION AT BOTH NAMS AND ALL SITES. 1975 - 1982.

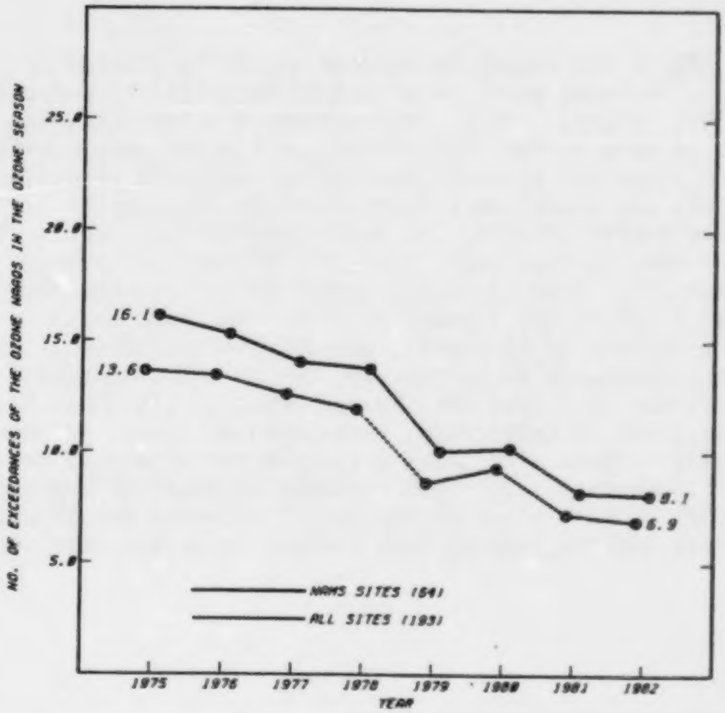

FIGURE 1-13. NATIONAL TREND IN THE COMPOSITE AVERAGE OF THE NUMBER OF DAILY EXCEEDANCES OF THE OZONE NAAQS IN THE OZONE SEASON AT BOTH NAMS AND ALL SITES. 1975 - 1982.

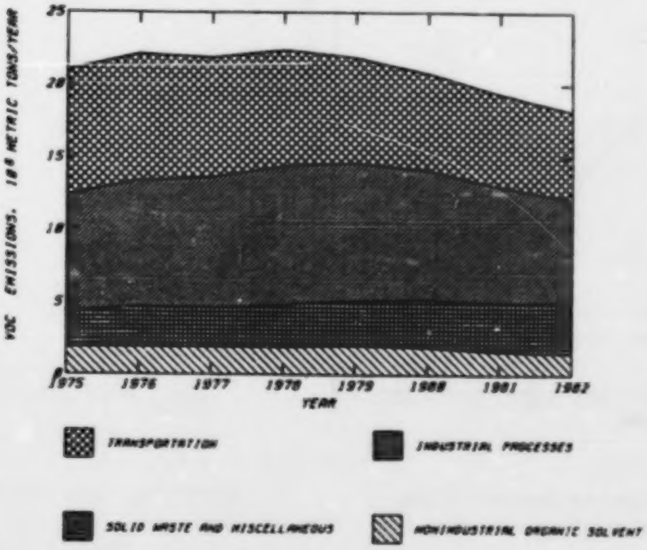

FIGURE 1-14. NATIONAL TREND IN EMISSIONS OF VOLATILE ORGANIC COMPOUNDS. 1975-1982.

Lead (PB) - The composite maximum quarterly average of ambient lead levels, recorded at 46 urban sites, decreased 64 percent between 1975 and 1982 (Figure 1-15). This sample of sites satisfied a minimum of 6 years of data in the 1975-82 time period and were heavily weighted by sites in Texas (51 percent) and Pennsylvania (23 percent). In all a total of only six states were represented in the sample. In order to increase the number of sites and their geographical representativeness lead trends were studied again over the 1979-82 time period. A total of 214 urban sites from 21 states satisfied the minimum data requirement of at least 3 out of the 4 years of data. An improvement in ambient lead concentrations of 43 percent was observed at these sites as compared with an improvement of 54 percent for the 46 sites mentioned above over this same 1979-82 period. Even this larger group of sites was disproportionately weighted by sites in California, Pennsylvania, Texas, Arizona, Illinois, and Minnesota. These six states accounted for almost 79 percent of the 214 sites represented. The lead consumed in gasoline dropped 69 percent from 1975-82, primarily due to the use of unleaded gasoline in catalyst equipped cars and the reduced lead content in leaded gasoline (Figure 1-16).

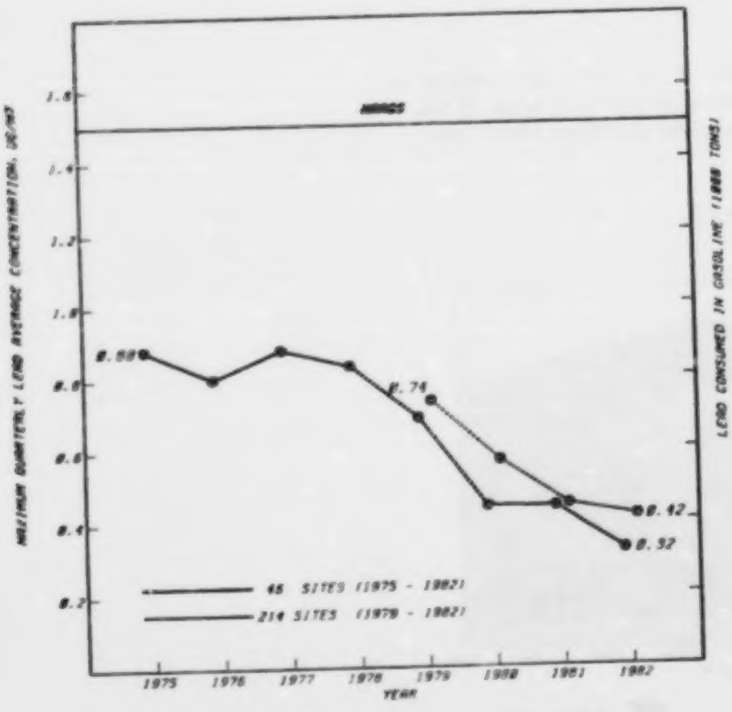

FIGURE 1-15. NATIONAL TREND IN MAXIMUM QUARTERLY AVERAGE LEAD LEVELS AT 46 SITES (1975 - 1982) AND 214 SITES (1979 - 1982).

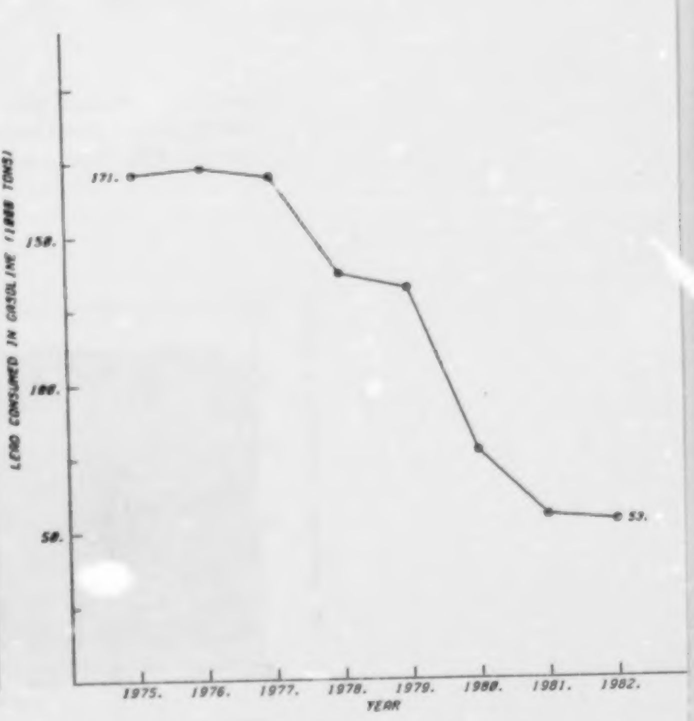

FIGURE 1-16. LEAD CONSUMED IN GASOLINE, 1975 - 1982.

(SALES TO THE MILITARY EXCLUDED)

1.3 REFERENCES

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2. INTRODUCTION

This report focuses on both long and short-term trends in each of the major pollutants as well as Regional and, where appropriate, specific Statewide air quality trends. Air quality trends are presented for both the National Air Monitoring Sites (NAMS) and other site categories. The NAMS were established through monitoring regulations promulgated in May 1979[1] to provide accurate and timely data to the U. S. Environmental Protection Agency (EPA) from a national air monitoring network. The NAMS are located in areas with high pollutant concentrations, high population exposure, or a combination of both. These stations meet uniform criteria for siting, quality assurance, equivalent analytical methodology, sampling intervals, and instrument selection to assure consistent data reporting among the States. Other sites operated by the State and local air pollution control agencies, such as the State and Local Air Monitoring Sites (SLAMS) and Special Purpose Monitors (SPM), in general, also meet the same rigid criteria, except that in addition to being located in the area of highest concentration and high population exposure, they are located in other areas as well.

In addition to ambient air quality, trends are also presented for annual nationwide emissions. These emissions are estimated using the best available engineering calculations; the ambient levels presented are averages of direct measurements. The emission trends are taken from the EPA publication, National Air Pollutant Emission Estimates, 1940-1982[2] and the reader is referred to this publication for more detailed information.

Air quality progress is measured by comparing the ambient air pollution levels with the appropriate primary and secondary National Ambient Air Quality Standards (NAAQS) for each of the pollutants (Table 2-1). Primary standards protect the public health; secondary standards protect the public welfare as measured by effects of pollution on vegetation, materials, and visibility. The standards are further categorized for long or short term exposure. Long-term standards specify an annual or quarterly mean that may not be exceeded; short-term standards specify upper limit values for 1-, 3-, 8-, or 24-hour averages. With the exception of the pollutant ozone, the short-term standards are not to be exceeded more than once per year. The ozone standard requires that the expected number of days per calendar year with daily maximum hourly concentrations exceeding 0.12 parts per million (ppm) be less than or equal to one.

The last section of this report, Air Quality Levels in Standard Metropolitan Statistical Areas (SMSA's); provides interested members of the air pollution control community, the private sector and the general public with greatly simplified air pollution information. Air quality statistics are presented for each of the pollutants for all SMSA's with populations exceeding 500,000 for the years 1980, 1981 and 1982.

TABLE 2-1. National Ambient Air Quality Standards (NAAQS)

POLLUTANT	PRIMARY (HEALTH RELATED)		SECONDARY (WELFARE RELATED)	
	AVERAGING TIME	CONCENTRATION	AVERAGING TIME	CONCENTRATION
TSP	Annual Geometric Mean	75 ug/m^3	Annual Geometric Mean	60 ug/m^3*
	24-hour	260 ug/m^3	24-hour	150 ug/m^3
SO_2	Annual Arithmetic Mean	(0.03 ppm) 80 ug/m^3	3-hour	1300 ug/m^3 (0.50 ppm)
	24-hour	(0.14 ppm) 365 ug/m^3		
CO	8-hour	(9 ppm) 10 mg/m^3	Same as Primary	
	1-hour	(35 ppm) 40 mg/m^3	Same as Primary	
NO_2	Annual Arithmetic Mean	(0.053 ppm) 100 ug/m^3	Same as Primary	
O_3	Maximum Daily 1-hour Average	(0.12 ppm) 235 ug/m^3	Same as Primary	
Pb	Maximum Quarterly Average	1.5 ug/m^3	Same as Primary	

*This annual geometric mean is a guide to be used in assessing implementation plans to achieve the 24-hour standard of 150 ug/m^3.

2.1 DATA BASE

The ambient air quality data used in this report were obtained from EPA's National Aerometric Data Bank (NADB). Air quality data are submitted to the NADB by both State and local governments, as well as federal agencies. At the present time, there are over 250 million air pollution measurements on the NADB, the vast majority of which represent the more heavily populated urban areas of the Nation.

As in last year's report[3], the size of the available air quality trends data base has been expanded by merging data at sites which have experienced changes in the agency operating the site, the instrument used, or a change in the project code, such as a change from residential to commercial. A discussion of the impact of the merging of the air quality data is presented in each of the individual pollutant discussions.

In order for a monitoring site to have been included in this analysis, the site had to contain at least 6 out of the 8 years of data in the period 1975 to 1982. Each year with data had to satisfy an annual data completeness criterion. To begin with, the air quality data are divided into two major groupings -- 24-hour measurements and continuous 1-hour measurements. The 24-hour measurements are obtained from monitoring instruments that produce one measurement per 24-hour period and are operated on a systematic sampling schedule of once every 6 days or 61 samples per year. Such instruments are used to measure TSP, SO_2, NO_2, and Pb. For these measurement methods, the NADB defines a valid quarter's record as one consisting of at least five sample measurements representively distributed among the months of that quarter. Distributions of measurements that show no samples in 2 months of a quarter or that show no samples in 1 month and only one sample in another month are judged unacceptable for calculating a representative estimate of the mean. A valid annual mean for TSP, SO_2 and NO_2, measured with this type of sampler, requires four valid quarters to satisfy the NADB criteria. For the pollutant lead, the data used has to satisfy the criteria for a valid quarter in at least 3 of the 4 possible quarters in a year.

The 1-hour data are obtained from monitoring instruments that operate continuously, producing a measurement every hour for a possible total of 8760 hourly measurements in a year. For continuous hourly data, a valid annual mean for SO_2 and NO_2 requires at least 4380 hourly observations. In the case of the NAAQS related statistics - the second maximum 24-hour SO_2 average, and the second maximum nonoverlapping 8-hour CO average - the same annual data completeness criterion of 4380 hours was required. This criterion was also used to calculate the estimated number of exceedances of the 24-hour average SO_2 and the 8-hour average CO standards.

Finally, because of the seasonal nature of ozone, both the second daily maximum 1-hour value and the estimated number of exceedances of the O_3 NAAQS was calculated for the ozone season, which varies by state.[4] For example, in California the ozone season is defined as 12 months, January through December, while in New Jersey it is defined as 7 months, April through October. In order for a site to be included it had to have at least 50 percent of the hourly data in the ozone season.

For all the pollutants, the site must satisfy the annual completeness criterion, specified above, in at least 6 out of 8 years to be included in the air quality trends data base.

In performing the national trend analyses, which follow, each site was weighted equally. The trend sites can be found in all 10 EPA Regions (Figure 2-1) with the exception of the 53 lead sites used for the long term trend analysis, 1975-1982. A comparison was made between EPA Regional population and the distribution of trend sites by pollutant (Table 2-2). Spearman rank correlation coefficients were computed[5], relating the 1980 Regional population with the number of trend sites. With the exception of the lead sites, statistically significant relationships were found between the distribution of trend sites and Regional population. This suggests that there is a relationship between population and the distribution of monitoring sites, as would be expected. In general, the trend sites are located in populated areas which have experienced air pollution problems. The data base for the lead trend sites is heavily weighted by concentrations of monitors in a relatively small number of States. This is addressed in the lead trends section of the report (Section 3.6).

2.2 TREND STATISTICS

The air quality analyses presented in this report comply with the recommendations of the Intra-Agency Task Force on Air Quality Indicators.[6] This task force was established in January 1980 to recommend standardized air quality indicators and statistical methodologies for presenting air quality status and trends. The Task Force report was published in February 1981. The air quality statistics used in these pollutant-specific trend analyses relate directly to the appropriate NAAQS's. Two types of standard-related statistics are used - peak statistics (the second maximum 24-hour SO_2 average, the second maximum nonoverlapping 8-hour CO average, and the second daily maximum 1-hour O_3 average) and long-term averages (the annual geometric mean for TSP, the annual arithmetic means for SO_2 and NO_2, and the quarterly arithmetic mean for lead). In the case of the peak statistics, the second maximum value is used, because this is the value which traditionally has been used to determine whether or not a site has or has not violated an air quality standard in a particular year, and, therefore, the second maximum value is of significant importance. A composite average of each of these statistics is used, by averaging each statistic over all available trend sites, in the graphical presentations which follow.

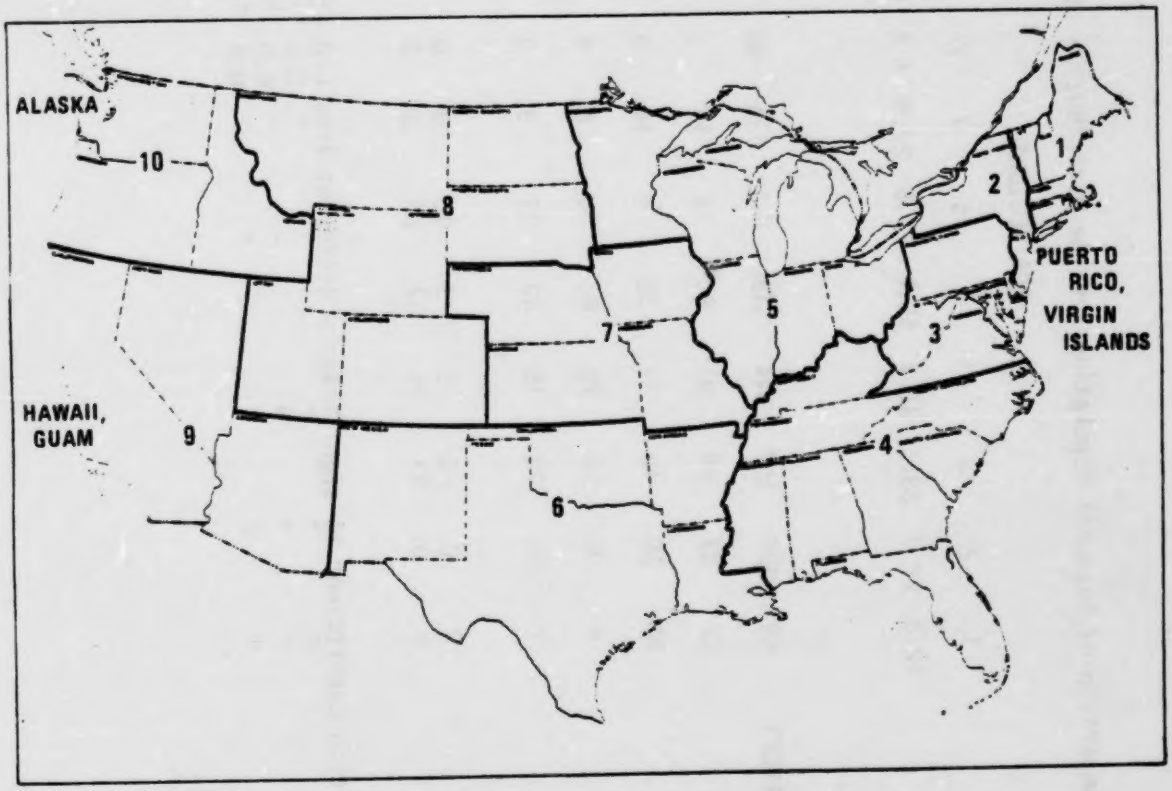
ALASKA
10
8
1
2
PUERTO RICO,
VIRGIN ISLANDS
5
7
3
HAWAII, GUAM
9
4
6

Figure 2-1. Ten regions of the U. S. Environmental Protection Agency.

TABLE 2-2. Comparison of Regional Population and the Distribution of Trend Sites by Pollutant

	EPA REGIONS										SPEARMAN RANK CORRELATION (Population vs. Pollutant Specific Sites)
	1	2	3	4	5	6	7	8	9	10	
REGIONAL POPULATION (millions)	12.3	28.7	23.5	35.7	45.1	11.6	22.9	6.4	25.7	7.3	
DISTRIBUTION OF SITES											
Total Suspended Particulate (TSP)	69	205	157	314	518	173	118	84	71	59	0.76 ***
Sulfur Dioxide (SO_2)	22	53	28	87	81	16	11	6	33	14	0.89 ****
Carbon Monoxide (CO)	10	35	10	11	30	9	14	9	54	14	0.56 *
Nitrogen Dioxide (NO_2)	9	6	16	72	82	30	6	9	45	1	0.74 **
Ozone (O_3)	7	20	28	16	42	17	9	9	40	5	0.63 *
Lead (Pb)											
46 Sites (1975-1982)	0	0	6	5	3	26	0	0	6	0	0.27
214 Sites (1979-1982)	6	0	53	16	32	29	2	2	70	4	0.32

****The Spearman Rank Correlation Coefficient is significantly different from 0.0 at $\alpha = 0.0005$
*** " " " " " " " " " 0.0 " $\alpha = 0.005$
** " " " " " " " " " 0.0 " $\alpha = 0.01$
* " " " " " " " " " 0.0 " $\alpha = 0.05$

In addition to the standard related statistics, other statistics are used, when appropriate, to further clarify observed air quality trends. Particular attention is given to the estimated number of exceedances of the short-term NAAQS's. The estimated number of exceedances is the measured number of exceedances adjusted to account for incomplete sampling.

The emission data are reported as teragrams (one million metric tons) emitted to the atmosphere per year.[2] These are estimates of the amount and kinds of pollution being generated by automobiles, factories, and other sources, based upon the best available engineering calculations for a given time period.

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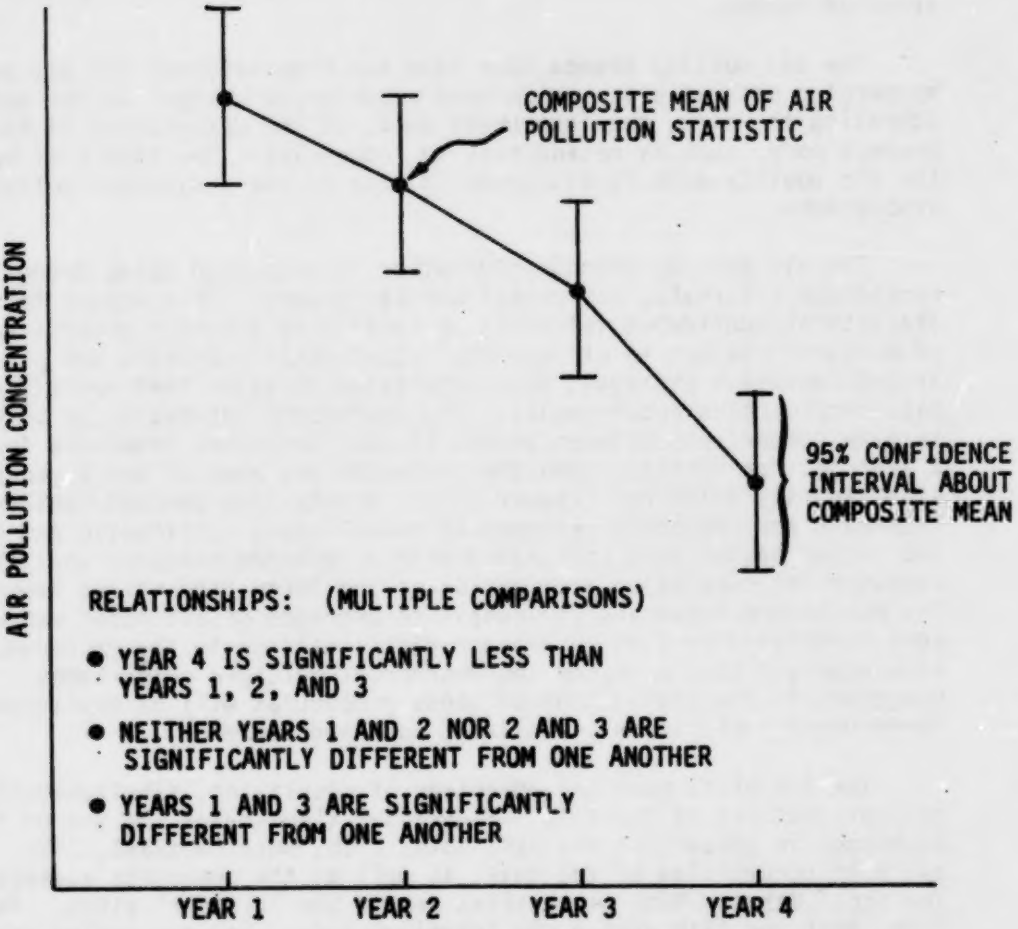
3. NATIONAL AND REGIONAL TRENDS IN CRITERIA POLLUTANTS

This chapter focuses on long-term trends in each of the six major pollutants. Comparisons are made between all the trend sites and the subset of NAMS. Trends are examined for both the Nation and the ten EPA Regions. Where appropriate, trend analyses are also presented for selected States.

The air quality trends data base has been expanded for all pollutants by merging data at sites which have experienced changes in the agency operating the site, the instrument used, or the designation of the project code, such as residential to commercial. The impact of merging the air quality data is discussed in each of the individual pollutant discussions.

The air quality trends information is presented using trend lines, confidence intervals, Box plots[1] and bar graphs. This report introduces statistical confidence intervals to facilitate a better understanding of measured changes in air quality. Confidence intervals are placed around composite averages, which are based on sites that satisfy annual data completeness requirements. The confidence intervals can be used to make comparisons between years; if the confidence intervals for any 2 years do not overlap, then the composite averages of the 2 years are significantly different (Figure 3-1). Ninety-five percent confidence intervals for composite averages of annual means (arithmetic and geometric) and second maxima were calculated with a repeated measures analysis of variance followed by an application of the Tukey Studentized Range.[2] The confidence intervals for composite averages of estimated exceedances were calculated by fitting Poisson distributions[3] to the exceedances each year and then applying the Bonferroni multiple comparisons procedure.[4] The utilization of these procedures will be explained in a forthcoming publication by Pollack, Hunt and Curran.[5]

The Box plots have the advantage of displaying, simultaneously, several features of the data. Figure 3-2 illustrates the use of this technique in presenting the 5th, 10th, 25th, 50th (median), 75th, 90th and 95th percentiles of the data, as well as the composite average. The 5th, 10th and 25th percentiles depict the "cleaner" sites. The 75th, 90th and 95th depict the "dirtier" sites, and the median and average describe the "typical" sites. For example, 90 percent of the sites would have concentrations lower than the 90th percentile. Although the average and median both characterize typical behavior, the median has the advantage of not being affected by a few extremely high observations. The use of the Box plots allow us to simultaneously compare trends in the "cleaner", "typical" and "dirtier" sites. Bar graphs are used for the Regional comparisons. The composite average of the appropriate air quality statistic of the earlier time period is compared with the



RELATIONSHIPS: (MULTIPLE COMPARISONS)

- YEAR 4 IS SIGNIFICANTLY LESS THAN YEARS 1, 2, AND 3
- NEITHER YEARS 1 AND 2 NOR 2 AND 3 ARE SIGNIFICANTLY DIFFERENT FROM ONE ANOTHER
- YEARS 1 AND 3 ARE SIGNIFICANTLY DIFFERENT FROM ONE ANOTHER

Figure 3-1 **Sample illustration of use of confidence intervals to determine statistically significant change.**

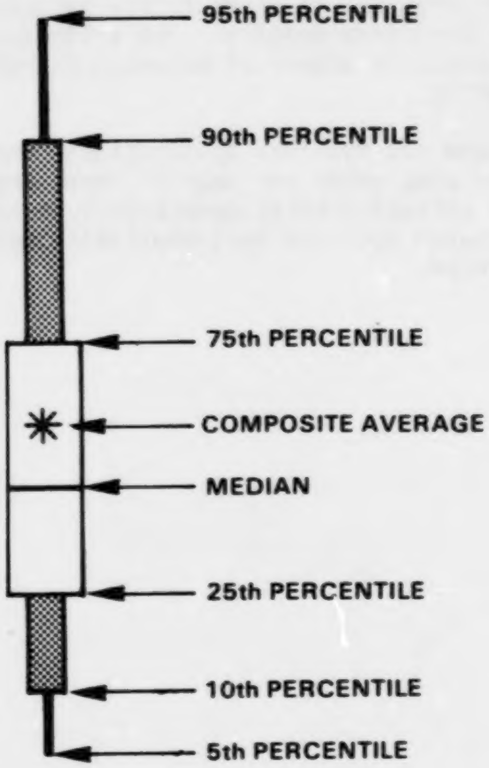

95th PERCENTILE
90th PERCENTILE
75th PERCENTILE
COMPOSITE AVERAGE
MEDIAN
25th PERCENTILE
10th PERCENTILE
5th PERCENTILE

Figure 3-2. Illustration of plotting conventions for box plots.

composite average of the later time period. The approach is simple and it allows the reader at a glance to compare the long term trend in all ten EPA Regions.

In addition to ambient air quality, trends are also presented for annual nationwide emissions. These emissions data are estimated using the best available engineering calculations.

In addition to the standard related statistics, other statistics are used, when appropriate, to further clarify observed air quality trends. Particular attention is given to the estimated number of exceedances of the short-term NAAQS's. The estimated number of exceedances is the measured number of exceedances adjusted to account for incomplete sampling.

The emission data are reported as teragrams (one million metric tons) emitted to the atmosphere per year.[3] These are estimates of the amount and kinds of pollution being generated by automobiles, factories, and other sources, based upon the best available engineering calculations for a given time period.

3.1 TRENDS IN TOTAL SUSPENDED PARTICULATE

TSP is a measure of suspended particles in the ambient air ranging up to 25-45 micrometers in diameter. These particles originate from a variety of stationary and mobile sources. TSP is measured using a "hi-volume" sampler which simply measures the total ambient particle concentration. It does not provide information regarding particle size. There are both annual geometric mean and 24-hour National Ambient Air Quality Standards for TSP. The annual geometric mean standard is 75 micrograms per cubic meter (ug/m^3) not to be exceeded more than once per year. Because the annual mean is a more stable estimation of air quality given the EPA recommended sampling frequency of once every 6 days, only the annual mean is used as a trend statistic.

3.1.1 LONG-TERM TSP TRENDS, 1975-81

The 8-year trend in average TSP levels, 1975-1982, is shown in Figure 3-3 for over 1700 sites geographically distributed throughout the Nation and for the subset of 347 National Air Monitoring Stations (NAMS) which are located in the large urban areas. The TSP levels are expressed in terms of the composite average annual geometric mean.

The curves shown in Figure 3-3 indicate a very slight decrease in composite levels from 1975-1981, followed by a sizeable decrease between 1981 and 1982. The NAMS sites show higher composite levels than the sites for the Nation in general, but appear to show a similar pattern. The composite average of TSP levels measured at 1768 sites nationally decreased 15 percent during the 1975 to 1982 time period and the NAMS decreased 19 percent. From the curves in Figure 3-3, it is clear that most of this decrease occurred between the measured levels of 1981 and 1982.

The large decrease in measured levels between 1981 and 1982 have prompted several investigations regarding the possible causes for this decrease. These include a study of the changes in meteorological conditions, emission levels, as well as possible changes in the measurement process for TSP.[6-9] In particular, several investigations have focused on the impact of possible differences in the glass fiber filters used on the hi-volume sampler. Since 1977, the glass filters have been centrally procured by EPA for the nation's monitoring sites for reasons of nationwide uniformity and costs. The competitive procurement process resulted in changes in the manufacturers of these filters three different times: in 1978, 1979 and 1981. Although important filter specifications were maintained throughout this period some physical characteristics of the filters varied which in turn prompted studies by air pollution control agencies to investigate the possible impact of the filter changes on measured TSP concentrations.[6,7]

Considering the findings of the aforementioned investigators, EPA now believes that the change in filter manufacturers has contributed, in part, to the recent change in measured TSP levels.[10] Differences in filter alkalinity, cited by Witz et al. of the California South Coast Air

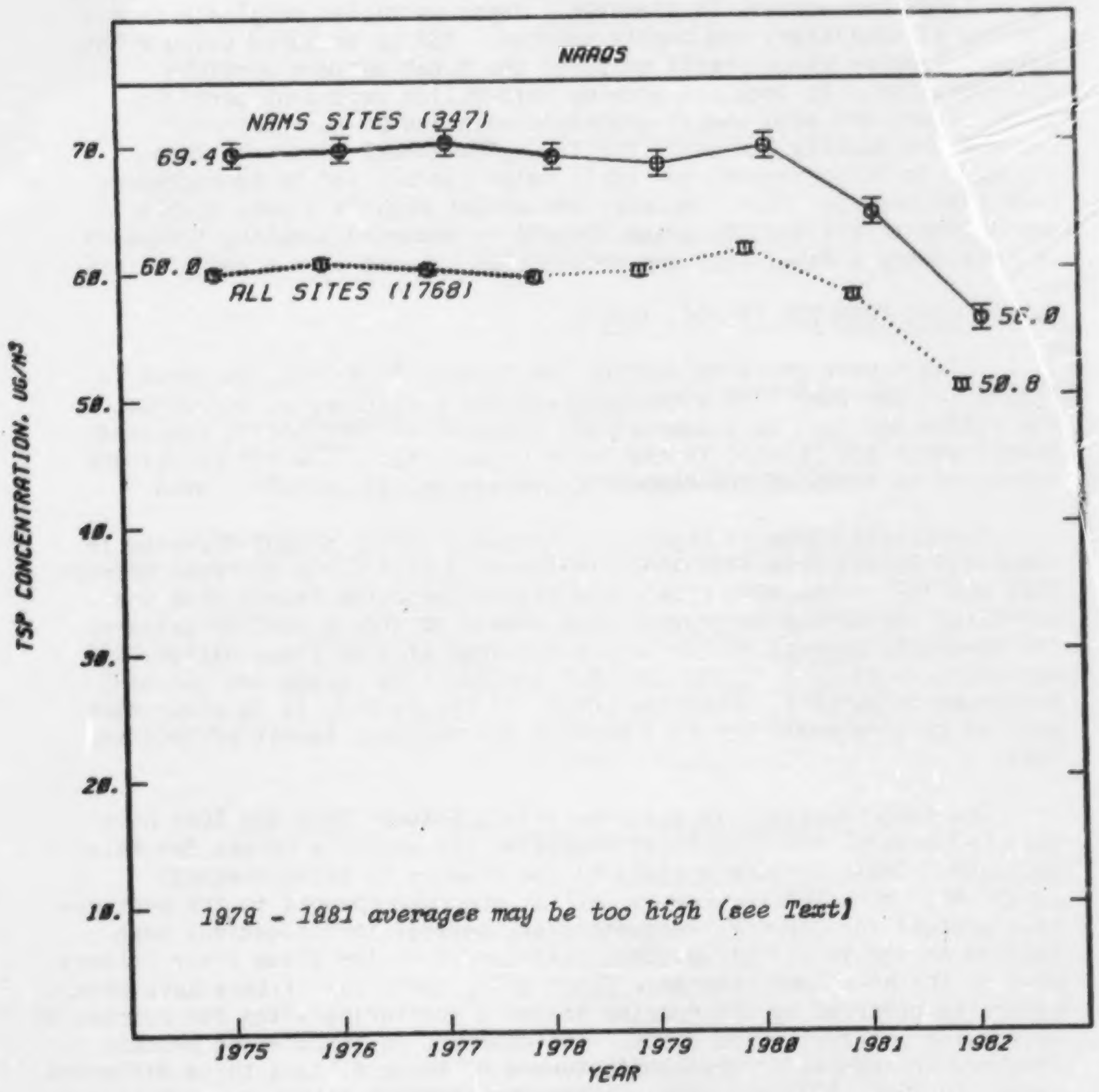


FIGURE 3-3. NATIONAL TREND IN THE COMPOSITE AVERAGE OF THE GEOMETRIC MEAN TOTAL SUSPENDED PARTICULATE AT BOTH NAMS AND ALL SITES WITH 95% CONFIDENCE INTERVALS, 1975 -1982.

Management District appears to be a plausible explanation for differences in measurements among the different filter manufacturers. Alkalinity, which was not previously included in EPA filters specifications, appears to be a better predictor than hydrogen ion concentration (pH) of artifact particulate matter formation (such as sulfates, nitrates and possibly organic acids) which would inflate TSP measurements. The alkalinity information is now available on glass fiber filters used during the years in question and can now be considered in the evaluation of the recent trend in measured TSP levels.[10]

Although the TSP trend analysis and the role of glass fiber filters is still under active investigation, preliminary estimates can be provided of the recent trend in ambient TSP levels. Using information on the alkalinity of the filters provided for the nation's monitoring networks from 1977 through 1982, it is reasonable to suspect that TSP levels for the years 1979 through 1981 are biased high relative to 1978 and 1982.[10] Fortunately, the similarity in alkalinity of the 1978 and 1982 filters and the fact that they were produced by the same manufacturer, suggests that the TSP levels for these years may be compared. It is reasonable, therefore, to describe the recent trend in TSP levels in terms of the change between 1978 and 1982.

In order to provide the best estimate of the improvement in TSP between 1978 and 1982, 1278 sites were examined which measured TSP in both years and satisfied the annual data completeness criteria in each year. The composite mean of the 1278 sites decreased 20 percent with a commensurate 21 percent for the subset of NAMS.

Figures 3-3 and 3-4 examine the air quality trend at 1768 sites over the 1975-1982 time period. This was done to evaluate the 1978 and 1982 TSP levels in the context of the 8 year period, which is used for all pollutants. Using 95 percent confidence intervals developed for these data (Figure 3-3), it can be seen that the 1982 levels are significantly lower than those of 1978. Box plots describing change in the distribution of annual means at the 1768 trend sites show a decrease in every percentile level (5, 10, 25, 50, 75, 90, and 95) between 1978 and 1982 (Figure 3-4). In addition, the range in air quality concentrations, as described by the distance between percentiles, is less in 1982 than in 1978. The pattern of the change for the intermediate years will be difficult to assess. It seems reasonable to conclude however, that a decrease in ambient TSP levels did occur between 1981 and 1982. Information from a geographically representative subset of the nation's monitoring sites which had one co-located sampler which used the same filter in both years, indicates that TSP concentrations decreased approximately 5 percent.[8] Thus, it appears that most of the decrease between 1981 and 1982 can be attributed to the filter change.

Nationwide TSP emission trends show an overall decrease of approximately 27 percent from 1975 to 1981. (See Table 3-1 and Figure 3-5). Since 1978, however, the particulate matter (PM) emissions have decreased 16 percent which is comparable to the estimated decrease in ambient TSP levels. The trend in PM emissions would not be expected to agree with

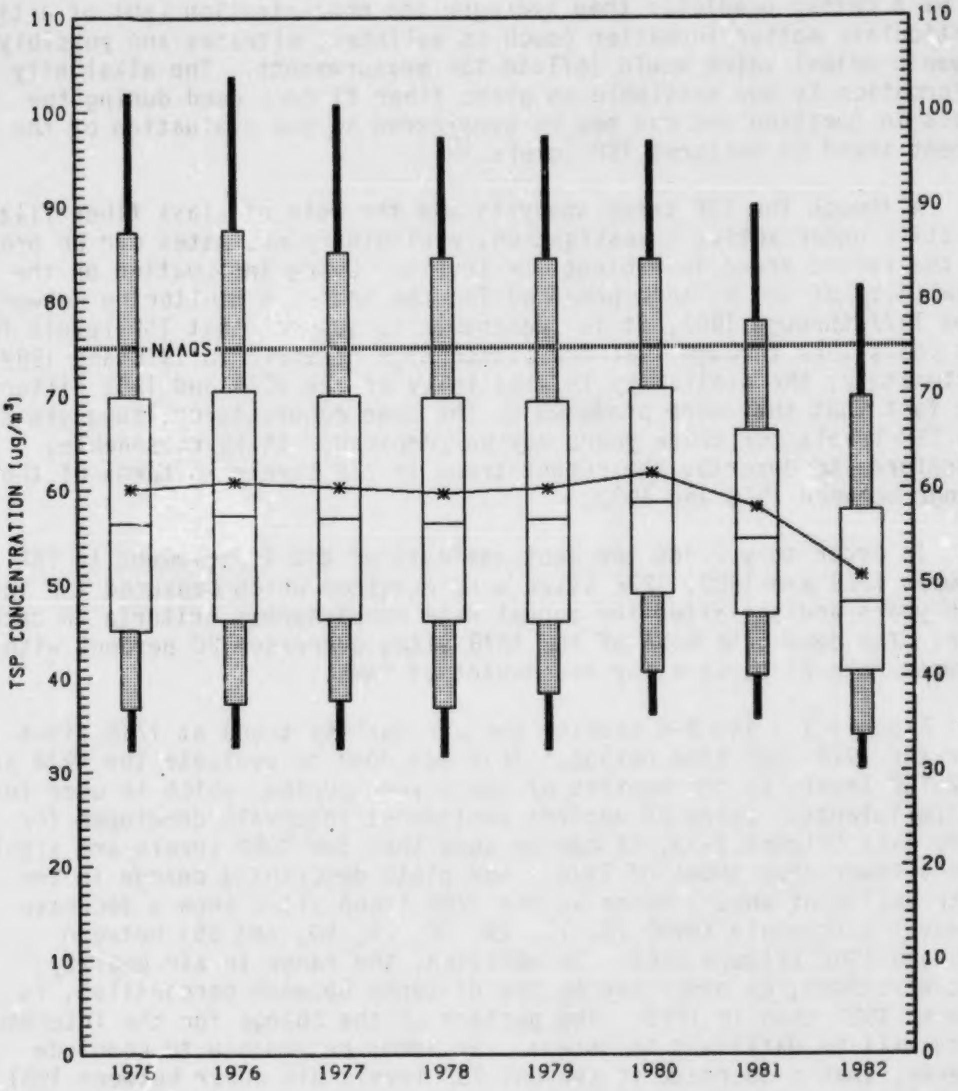


FIGURE 3-4. BOXPLOT COMPARISONS OF TRENDS IN ANNUAL GEOMETRIC MEAN TOTAL SUSPENDED PARTICULATE CONCENTRATIONS AT 1768 SITES, 1975 - 1982.

Table 3-1. National Particulate Emission Estimates, 1975-1982.

(10^6 metric tons/year)

Source Category	1975	1976	1977	1978	1979	1980	1981	1982
Transportation	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.3
Fuel combustion	2.6	2.4	2.4	2.3	2.5	2.5	2.6	2.4
Industrial Processes	5.0	4.4	4.0	4.0	3.8	3.2	2.8	2.4
Solid Waste & Miscellaneous	1.3	1.4	1.2	1.2	1.3	1.5	1.3	1.4
Total	10.3	9.6	9.0	8.9	9.0	8.6	8.1	7.5

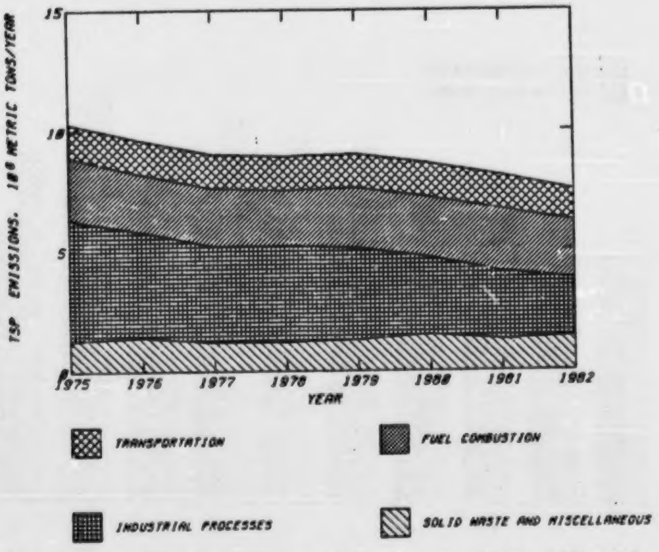


FIGURE 3-5. NATIONAL TREND IN PARTICULATE EMISSIONS, 1975-1982.

the trend in ambient TSP levels due to unaccounted for natural PM background and uninventoried emissions sources such as reentrained dust. The apparent agreement between estimates of ambient air quality and emissions may be due in part to the favorable role of meteorology in 1982. An analysis of meteorological conditions for 1982 indicated a potential for lower TSP concentrations due to abnormally high precipitation. This would have had the effect of minimizing fugitive dust entrainment and washing particles out of the air.

The reduction in particulate emissions occurred primarily because of the reductions in industrial processes. This is attributed to a combination of installation of control equipment and reduced industrial activity. Other areas of TSP emission reductions include reduced coal burning by non-utility users, installation of control equipment by electric utilities that burn coals, and a decrease in the burning of solid waste.[5]

3.1.2 Regional Trends

Figure 3-6 shows a comparison of the change in TSP levels by EPA Regions in terms of the 1978 versus 1982 levels. All Regions showed decreases over this time period. The Regions which showed the largest decreases, (III, V, VII, IX, X) either had large reductions in emissions or were affected by favorable meteorology in 1982 or were influenced by a combination of both.

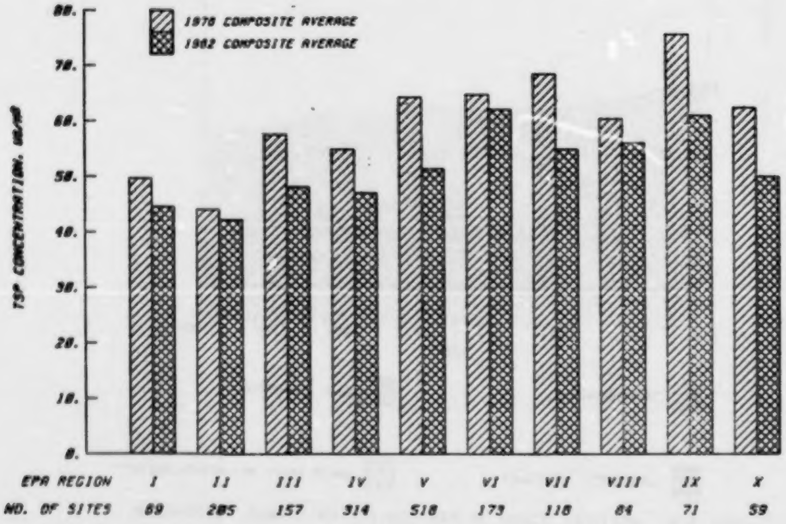


FIGURE 3-6. REGIONAL COMPARISON OF THE 1978 AND 1982 COMPOSITE AVERAGE OF THE GEOMETRIC MEAN TOTAL SUSPENDED PARTICULATE.

3.2 TRENDS IN SULFUR DIOXIDE

Ambient sulfur dioxide (SO_2) results primarily from stationary source coal and oil combustion and from nonferrous smelters. There are three NAAQS for SO_2: an annual arthmetic mean of 0.03 ppm, a 24-hour level of 0.14 ppm and a 3-hour level of 0.50 ppm. The first two standards are primary (health-related) standards, while the 3-hour NAAQS is a secondary (welfare-related) standard. The annual standard is not to be exceeded, while the short-term standards are not to be exceeded more than once per year. The trend analyses which follow are presented for the primary NAAQS.

SO_2 is measured using either a continuous monitoring instrument, which can collect as many as 8760 hourly values a year, or a 24-hour bubbler, which collects one measurement per 24-hour period and is operated on a sampling schedule of once every 6 days. Prior to 1978, most SO_2 monitors were 24-hour bubblers. In 1978, the EPA required that all SO_2 bubblers be modified with a temperature control device to rectify a sampling problem, when the temperature rose too high, not all of the SO_2 present was collected. Therefore, the SO_2 sample collected tended to be underestimated.[12] After 1978, many SO_2 bubblers were retired. Therefore, the bubbler data were not used in the trend analysis, because the instrument modification would complicate the interpretation of the trends analysis. Further, given the bubbler sampling frequency of once every 6 days, the SO_2 peak statistics would be underestimated and not comparable to those obtained from the continuous instruments.

The trends in ambient concentrations are derived from continuous monitoring instruments which can measure as many as 8760 hourly values per year. The SO_2 measurements reported in this section are summarized into a variety of summary statistics which relate to the SO_2 NAAQS. The statistics on which ambient trends will be reported are the annual arithmetic mean concentration, the second highest annual 24-hour average (measured midnight to midnight), and the expected annual number of 24-hour exceedances of 0.14 ppm (24-hour NAAQS).

3.2.1 Long-term Trends, 1975-82

The long-term trend in ambient SO_2, 1975-1982, is graphically presented in Figures 3-7 to 3-9. In each figure, the trend at the NAMS is contrasted with the trend at all sites. For each of the statistics presented, a steady downward trend is evident. Nationally, the annual mean SO_2, examined at 351 sites, decreased at a median rate of approximately 5 percent per year; this resulted in an overall change of about 33 percent (Figure 3-7). The subset of 88 NAMS recorded higher average concentrations but declined at a higher rate of 8 percent per year.

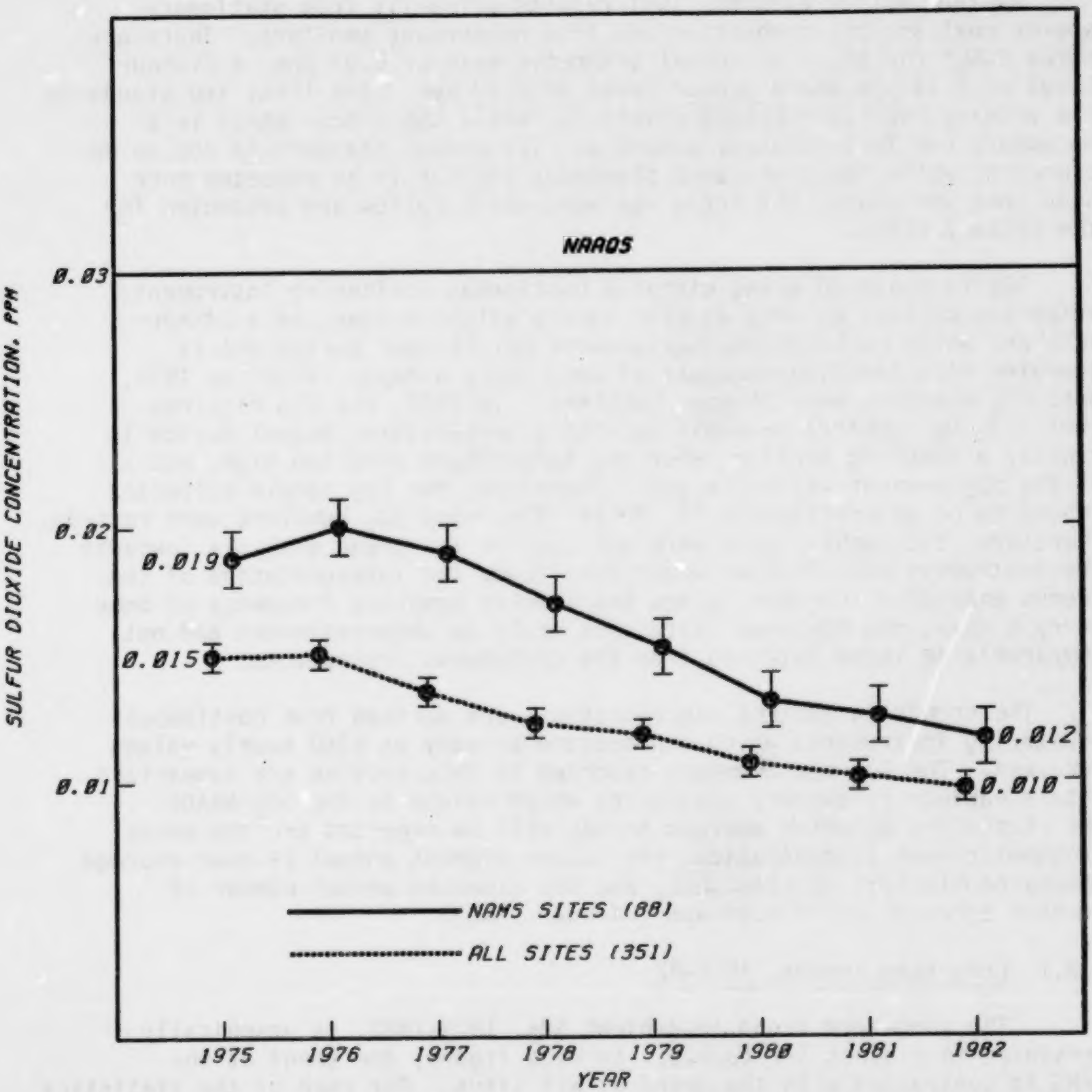


FIGURE 3-7. NATIONAL TREND IN THE ANNUAL AVERAGE SULFUR DIOXIDE CONCENTRATION AT BOTH NAMS AND ALL SITES WITH 95% CONFIDENCE INTERVALS, 1975 - 1982.

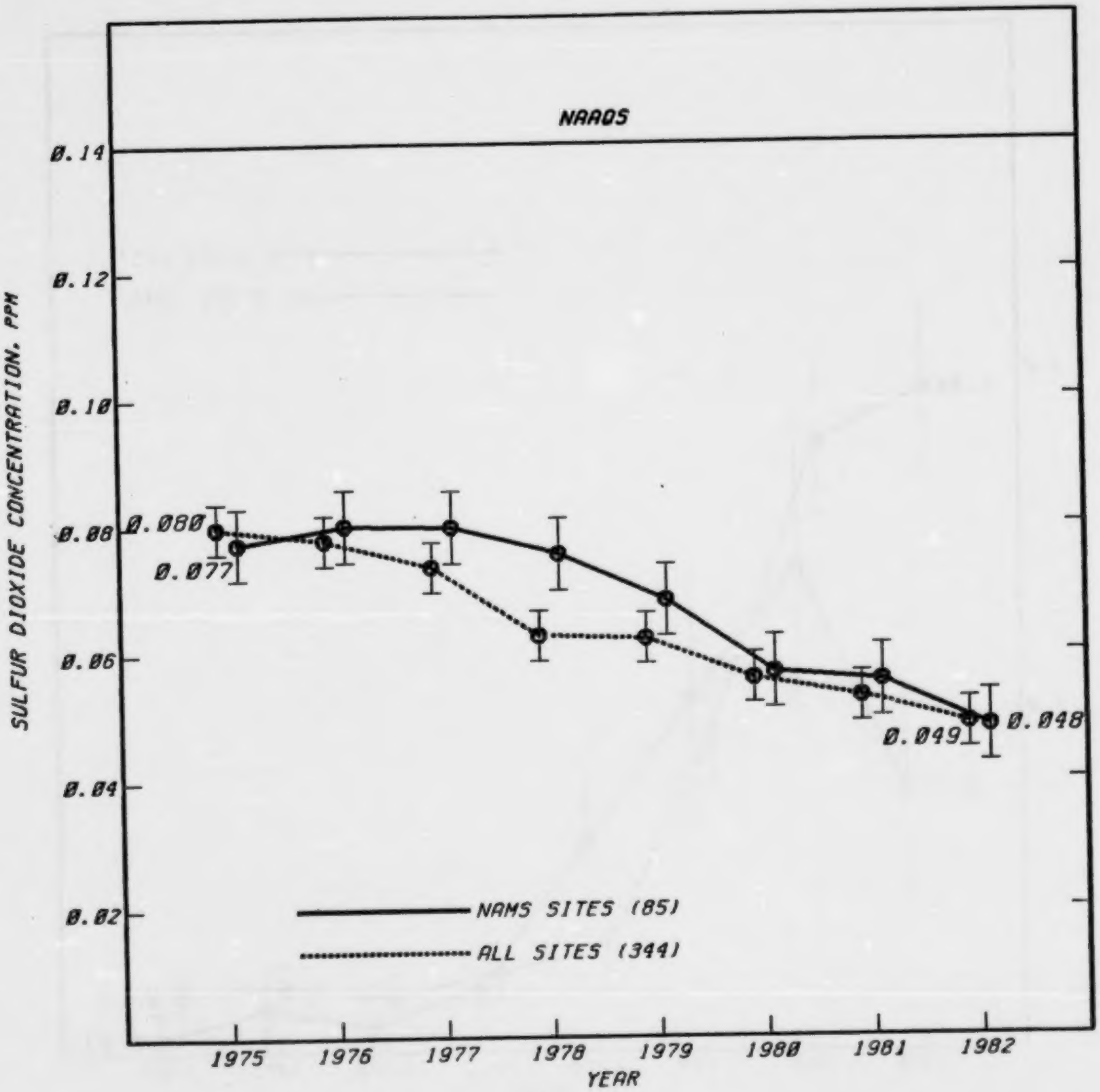


FIGURE 3-8. NATIONAL TREND IN THE COMPOSITE AVERAGE OF THE SECOND-HIGHEST 24-HOUR SULFUR DIOXIDE CONCENTRATION AT BOTH NAMS AND ALL SITES WITH 95% CONFIDENCE INTERVALS, 1975 - 1982.

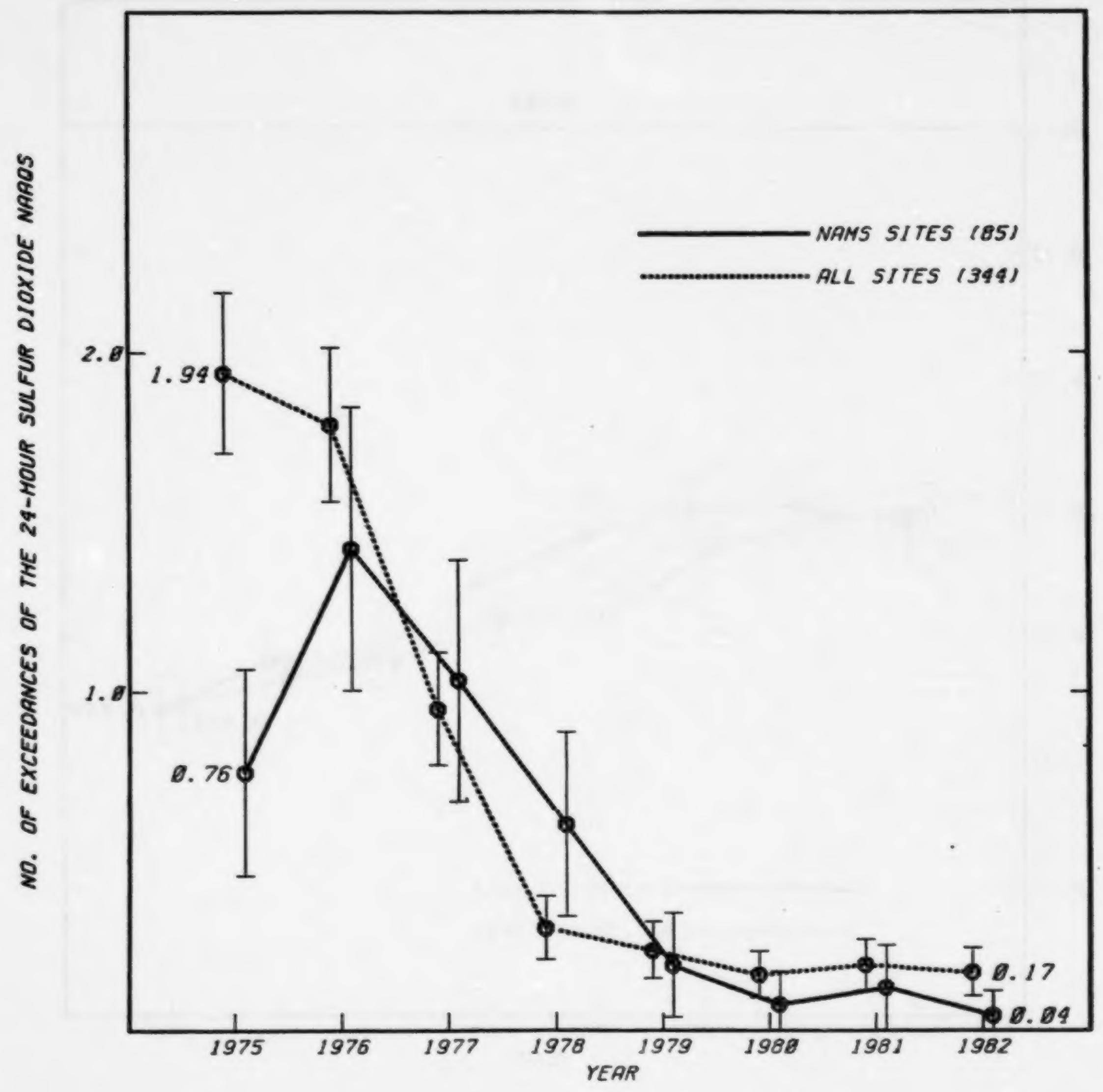


FIGURE 3-9. NATIONAL TREND IN THE COMPOSITE AVERAGE OF THE ESTIMATED NUMBER OF EXCEEDANCES OF THE 24-HOUR SULFUR DIOXIDE NAAQS AT BOTH NAMS AND ALL SITES WITH 95% CONFIDENCE INTERVALS. 1975 - 1982.

The annual second highest 24-hour values displayed a similar decline between 1975 and 1982. Nationally, among 344 stations with adequate trend data, the average rate of change was 5 percent per year with an overall decline of 39 percent (Figure 3-8). The 85 NAMS exhibited a similar rate of improvement for an overall change of 36 percent. While the NAMS are higher than other population oriented sites, the national composite includes not only population-oriented sites, but high concentration sites at smelter locations, as well. The estimated number of exceedances also showed declines for the NAMS as well as the composite of all sites (Figure 3-9). The vast majority of SO_2 sites do not show any exceedances of the 24-hour NAAQS. Most of the exceedances as well as the bulk of the improvements occurred at source oriented sites including a few smelter sites in particular. The apparent increase in exceedances for the NAMS during the beginning of the trend period is largely due to a NAMS site in Salt Lake City, Utah. There is considerable variability in the number of exceedances at this site with the number of exceedances in 1976 being considerably greater than other years. This single site has caused the trend at the NAMS sites to peak in 1976.

The statistical significance of these long-term trends is graphically illustrated on Figures 3-7 to 3-9 with the 95 percent confidence intervals included on these figures. For both annual averages and peak 24-hour values, the SO_2 levels in 1982 are statistically different than levels observed during the 1970's. For expected exceedances of the 24-hour standard with its higher variability and more rapid decline, current levels are statistically different than average exceedances in earlier years (1975-1978 for the NAMS and 1975-1977 for the national composite).

The intra-year variability for annual mean and second highest 24-hour SO_2 concentrations is graphically displayed in Figures 3-10 and 3-11. These figures show that higher concentrations decreased more rapidly and the concentration range among sites has diminished.

Sulfur oxide emissions are dominated by electric utilities and the trend generally tracks the pattern of ambient data. (See Table 3-2 and Figure 3-12). Emissions increased from 1975 to 1976 due to improved economic conditions, but decreased since then reflecting the installation of flue gas desulfurization controls at coal-fired electric generating stations and a reduction in the average sulfur content of fuels consumed. Emissions from other stationary source fuel combustion sectors also declined, mainly due to decreased combustion of coal by these consumers. Sulfur oxide emissions from industrial processes are also significant. Emissions from industrial processes have declined, primarily as the result of controls implemented to reduce emissions from nonferrous smelters and sulfuric acid manufacturing plants.[11]

Nationally, sulfur oxide emissions decreased 17 percent from 1975 to 1982. The difference between emission trends and air quality trends arises because the use of high sulfur fuels was shifted from power plants in urban areas, where most of our monitors are, to power plants

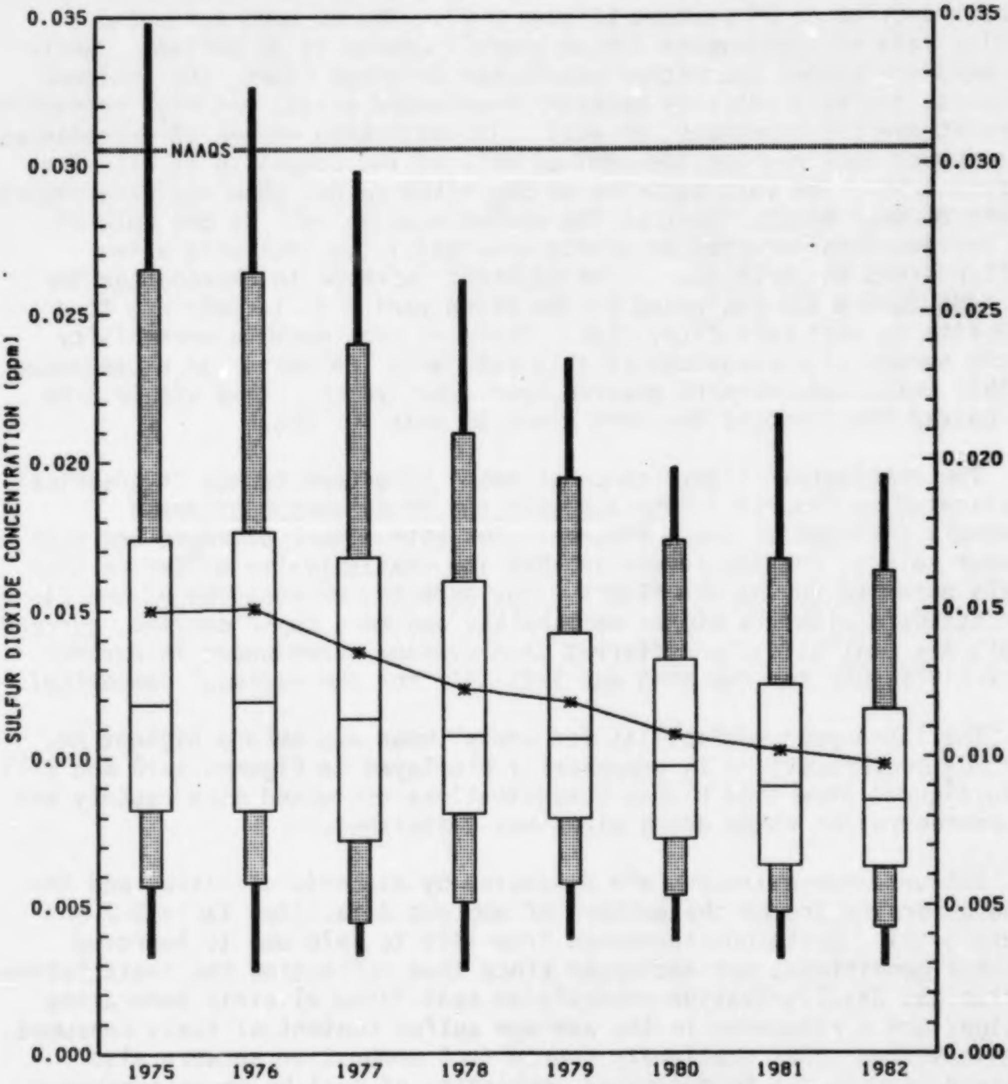


FIGURE 3- 10. BOXPLOT COMPARISONS OF TRENDS IN ANNUAL MEAN SULFUR DIOXIDE CONCENTRATION AT 344 SITES, 1975 - 1982.

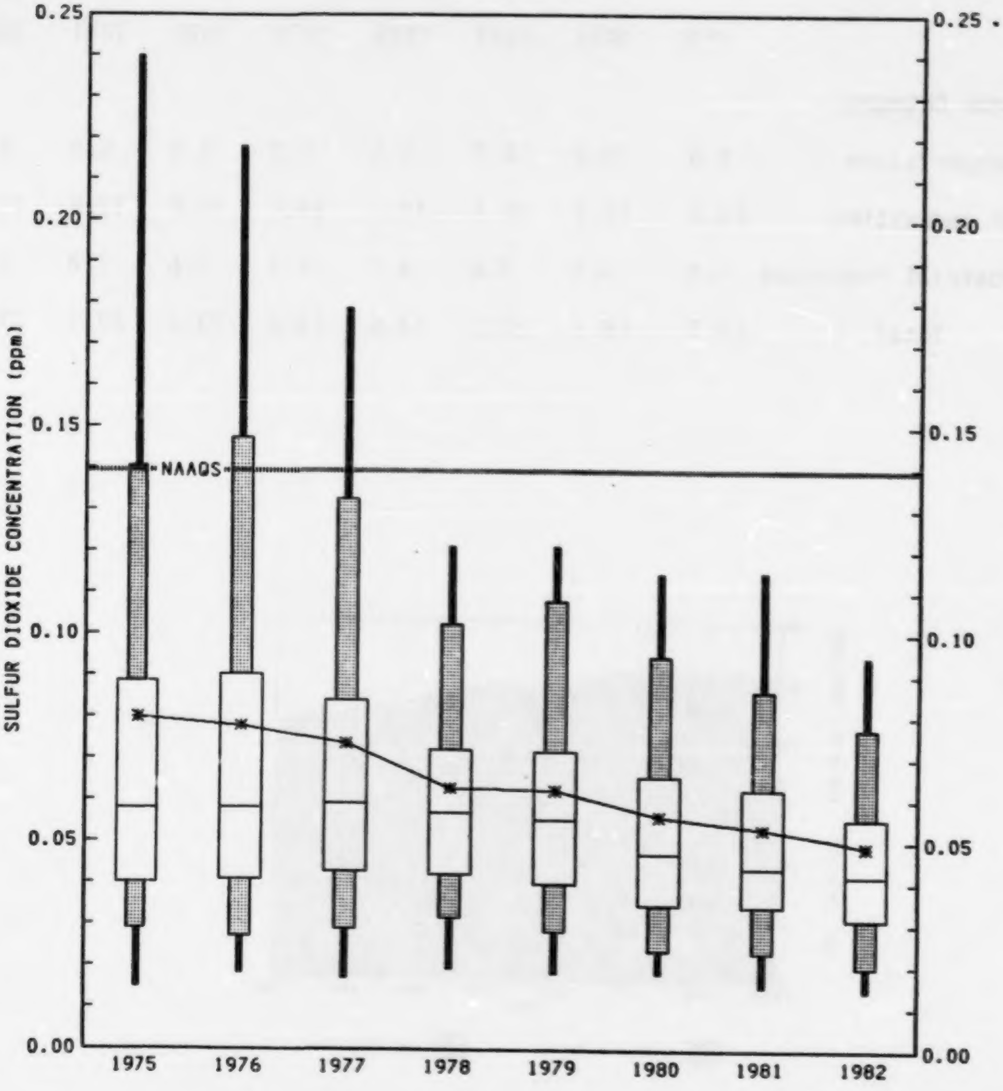


FIGURE 3-11 BOXPLOT COMPARISONS OF TRENDS IN SECOND HIGHEST 24-HOUR AVERAGE SULFUR DIOXIDE CONCENTRATIONS AT 344 SITES, 1975 -1982.

Table 3-2. National Sulfur Oxide Emission Estimates, 1975-1982

(10^6 metric tons/year)

Source Category	1975	1976	1977	1978	1979	1980	1981	1982
Transportation	0.6	0.8	0.8	0.8	0.9	0.9	0.9	0.9
Fuel combustion	20.3	20.9	21.1	19.6	19.4	18.8	17.8	17.4
Industrial Processes	4.8	4.6	4.4	4.2	4.3	3.6	3.8	3.1
Total	25.7	26.3	26.3	24.6	24.6	23.3	22.5	21.4

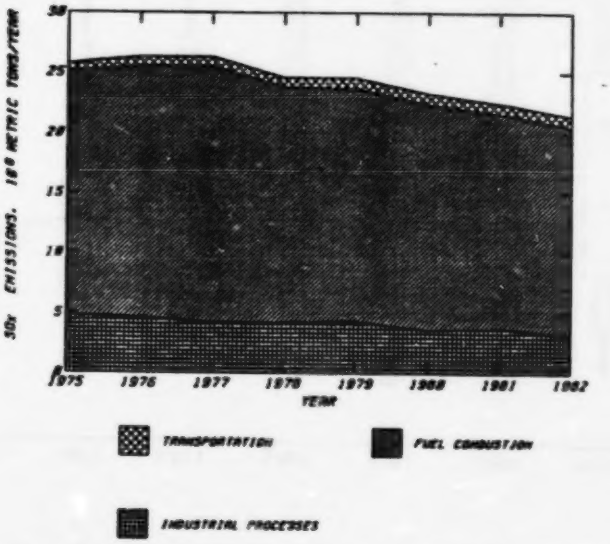


FIGURE 3-12. NATIONAL TREND IN SULFUR OXIDE EMISSIONS. 1975-1982.

in rural areas which have fewer monitors. Further, the residential and commercial areas, where the monitors are located, have shown sulfur oxide emission decreases comparable to SO_2 air quality improvement. These decreases in sulfur oxide emissions are due to a combination of energy conservation measures and the use of cleaner fuels in the residential and commercial areas.

3.2.2 Regional Trends

The annual mean SO_2 levels decreased in nine EPA Regions from 1975-1981 (Figure 3-13). Only Region VI had a majority of sites increasing over this time period. These sites were primarily monitors located in areas with low SO_2 concentrations. For the second high 24-hour values, the long-term change showed similar patterns.

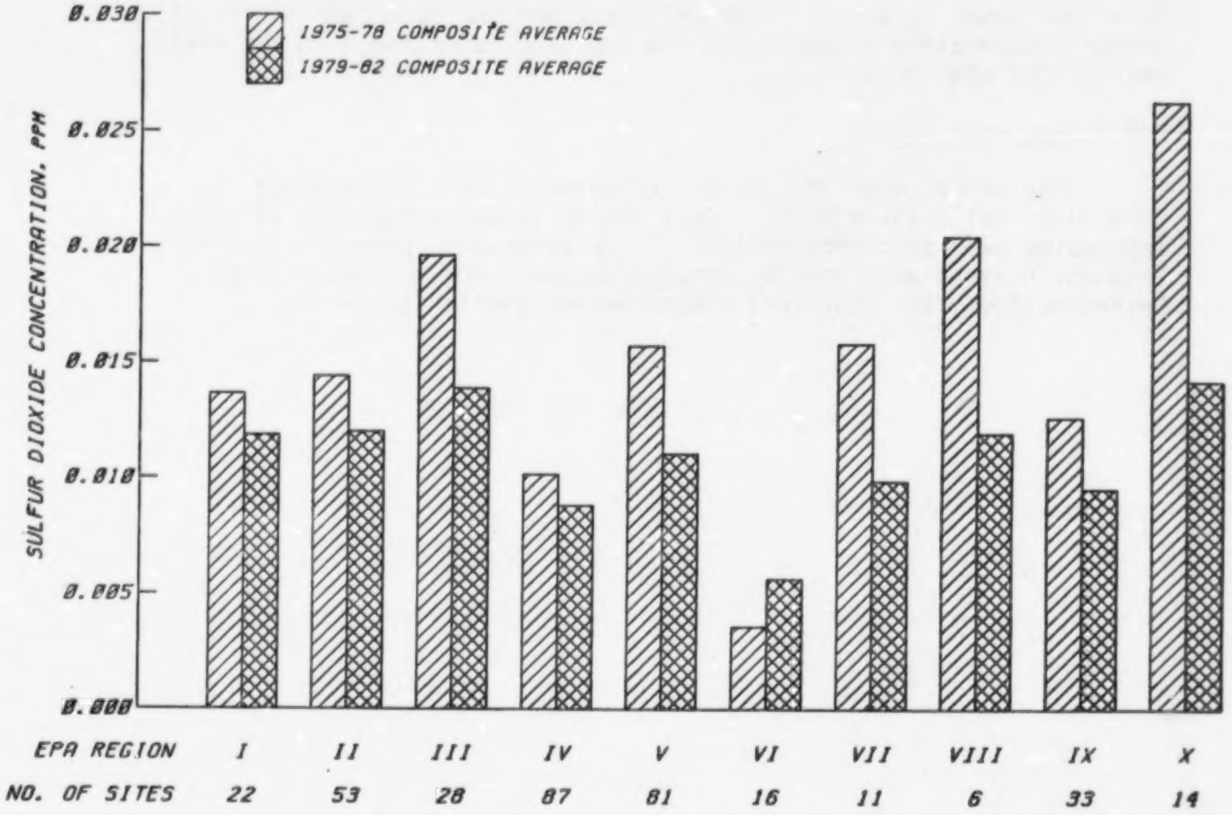


FIGURE 3-13. REGIONAL COMPARISON OF THE 1975-78 AND 1979-82 COMPOSITE AVERAGE OF THE ANNUAL AVERAGE SULFUR DIOXIDE CONCENTRATIONS.

3.3 TRENDS IN CARBON MONOXIDE

Highway motor vehicles are the largest contributing source of carbon monoxide (CO) emissions. There are both 1-hour and 8-hour NAAQS for CO. The 1-hour standard specifies a level of 35 ppm not to be exceeded more than once per year while the 8-hour standard specifies a level of 9 ppm not to be exceeded more than once per year. Because the 8-hour standard is generally more restrictive, this section focuses primarily on the 8-hour data.

The trends site selection process, discussed in Section 2.1, resulted in a data base of 196 sites for CO, including 41 sites that have been designated as National Air Monitoring Sites (NAMS). While slightly more than 20 percent of the trend sites reflect merged data, there was no significant difference in the overall trends between the merged and unmerged sites.

3.3.1 LONG-TERM CARBON MONOXIDE TRENDS: 1975-82

The 1975-82 composite average trend for the second highest non-overlapping 8-hour CO value is shown in Figure 3-14 for the 196 trend sites and the subset of 41 NAMS. The national composite decreased by 31 percent between 1975 and 1982 for all sites and for the subset of NAMS. The median rate of improvement was approximately 5 percent per year and, during the 1975-82 time period, 88 percent of these sites showed long-term improvement. The confidence intervals displayed in Figure 3-14 further substantiate this long-term decrease in ambient CO levels with the more recent levels being significantly less than those in earlier years. Figure 3-15 presents this same trend but the box-plot presentation highlights the consistent improvement at sites with higher concentration levels as seen in the steady year to year decreases in the upper percentiles of these sites. Therefore, not only have CO levels improved on the average but the number of sites with high CO levels has been reduced.

Figure 3-16 illustrates the composite average trend for the estimated number of exceedances of the 8-hour CO NAAQS which was adjusted to account for incomplete sampling. This statistic is also consistent with the longterm improvement, although the decrease is more pronounced, with an 87 percent reduction for the average of all 196 sites and a comparable 84 percent decrease for the NAMS.

Between 1975 and 1982 national carbon monoxide emissions are estimated to have decreased by 11 percent. (See Table 3-3 and Figure 3-17). These emission trend estimates show a slight rise between 1975 and 1976 followed by consistent decreases each year through 1982. Highway vehicle emissions, which represent the dominant contribution to ambient

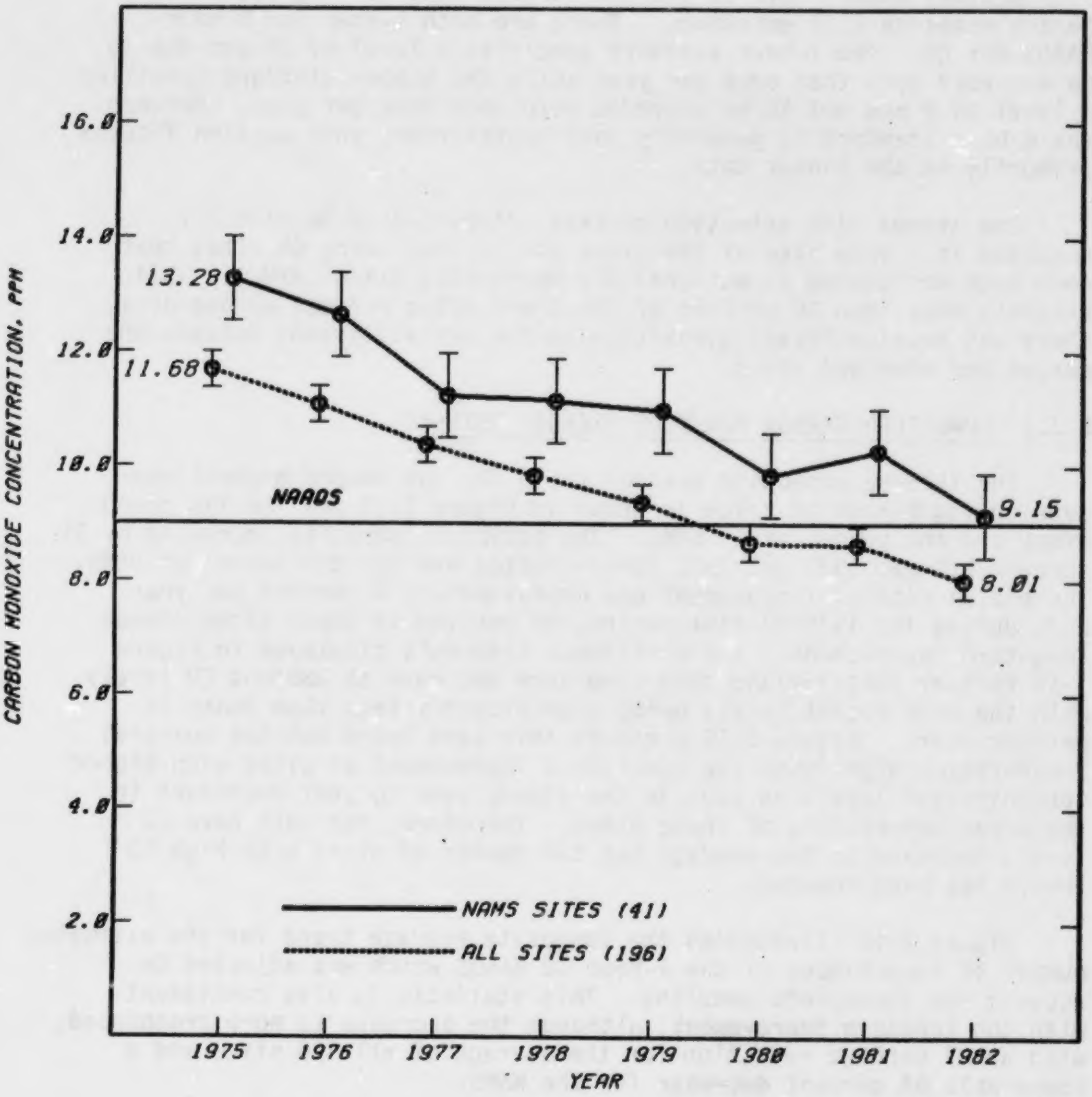


FIGURE 3-14. NATIONAL TREND IN THE COMPOSITE AVERAGE OF THE SECOND HIGHEST NONOVERLAPPING 8-HOUR AVERAGE CARBON MONOXIDE CONCENTRATION AT BOTH NAMS AND ALL SITES WITH 95% CONFIDENCE INTERVALS, 1975 -1982.

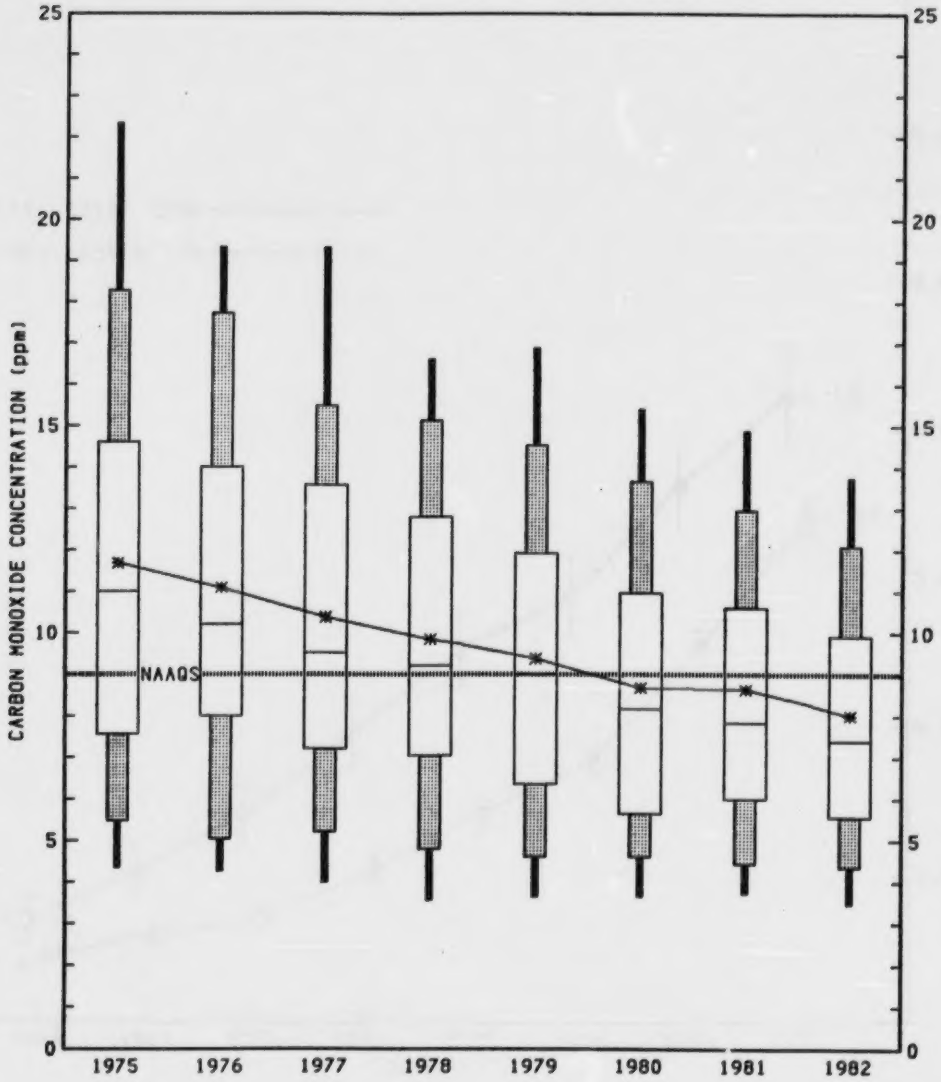


FIGURE 3-15. BOXPLOT COMPARISONS OF TRENDS IN SECOND HIGHEST NONOVERLAPPING 8-HOUR AVERAGE CARBON MONOXIDE CONCENTRATIONS AT 196 SITES, 1975 -1982.

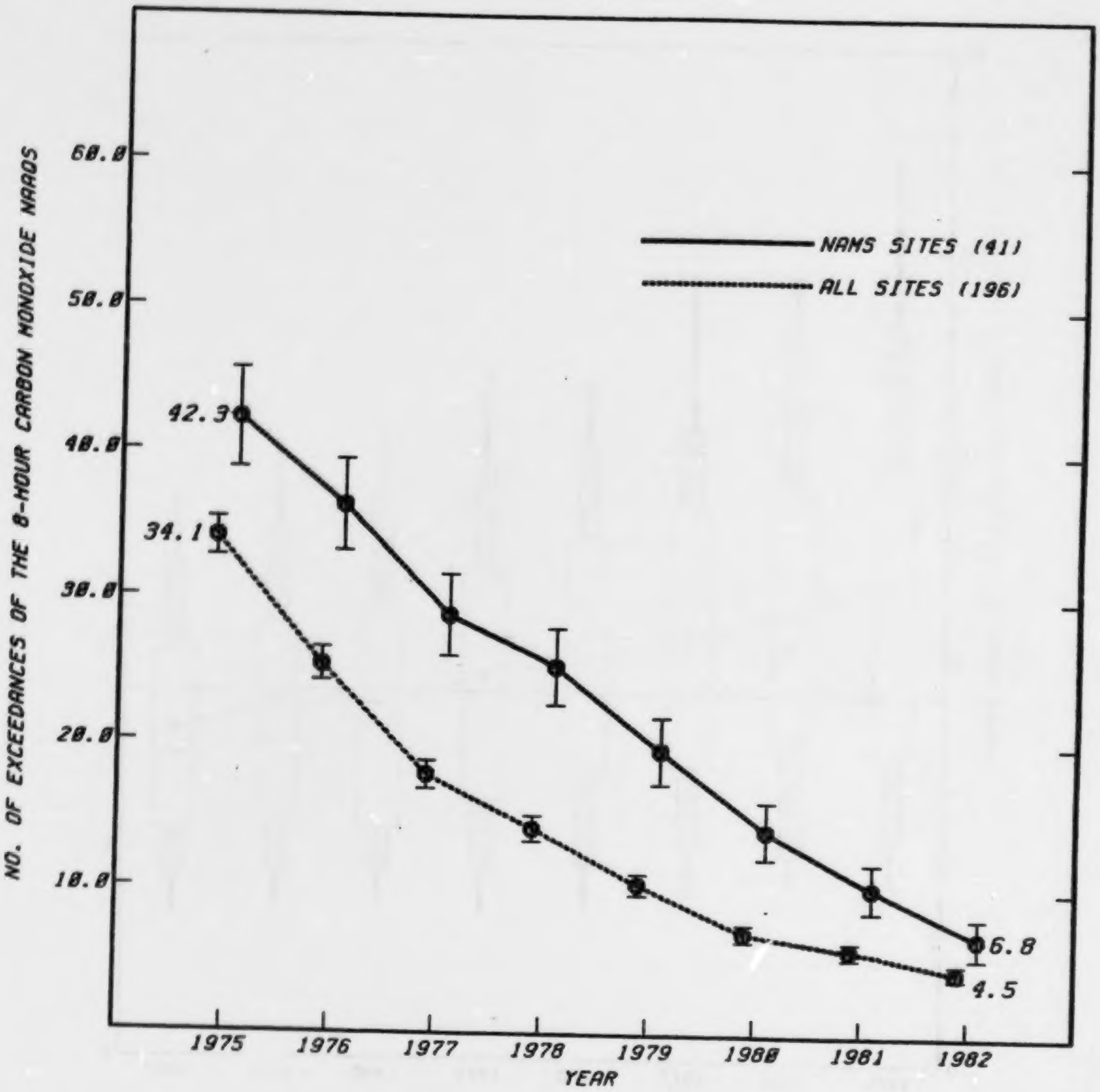


FIGURE 3-16. NATIONAL TREND IN THE COMPOSITE AVERAGE OF THE ESTIMATED NUMBER OF EXCEEDANCES OF THE 8-HOUR CARBON MONOXIDE NAAQS AT BOTH NAMS AND ALL SITES WITH 95% CONFIDENCE INTERVALS, 1975 - 1982.

levels, decreased 17 percent between 1975 and 1982. In attempting to compare ambient trends and emission trends for CO, it is important to recognize that the trend in estimated CO emissions for highway vehicles involves two main components: emissions per vehicle miles of travel and the number of vehicle miles of travel. The Federal Motor Vehicle Control Program has been successful since the early 1970's in reducing CO emissions per vehicle miles of travel, but the net effect on national CO emissions was dampened by an increase of 16 percent in vehicle miles of travel between 1975 and 1978. However, from 1978 to 1982 it is estimated that the vehicle miles of travel were more stable so that the impact of the emissions controls is more apparent as evidenced by the 16 percent decrease in highway vehicle emissions between 1978 and 1982.[11] The extent to which ambient trends agree with the nationwide emission trends depends upon whether the local traffic patterns around these trend sites are consistent with the trends in national averages for vehicle miles of travel. Because CO monitors are typically located to identify potential problems, they are likely to be placed in traffic saturated areas that do not experience significant increases in vehicle miles of travel. Therefore the rate of CO air quality improvement would be faster than the CO emission trend, because the CO air quality trend is less likely to be influenced by increases in traffic.

3.3.2 REGIONAL CARBON MONOXIDE TRENDS

Figure 3-18 displays the 1975-78 and 1979-82 composite averages of the second highest non-overlapping 8-hour CO concentrations by EPA Region. This illustrates that the long-term improvements observed nationally occurred in all Regions. In each Region, the majority of sites showed long-term improvement during the 1975-82 time period. It should be noted that these Regional graphs are primarily intended to depict relative change in CO levels during this time period and not the typical levels in each Region. Because the mix of sites may vary from one area to another, with one set of sites dominated by center-city monitors in large urban areas while another set of sites may represent a more diversified mix, this graph is not intended to be indicative of Regional differences in absolute concentration levels.

Table 3-3. National Carbon Monoxide Emission Estimates, 1975-1982.

(10^6 metric tons/year)

Source Category	1975	1976	1977	1978	1979	1980	1981	1982
Transportation	63.9	66.2	63.0	62.1	58.0	55.3	54.6	53.3
Industrial Processes	6.9	7.1	7.2	7.1	7.1	6.3	5.9	4.8
Solid Waste, Fuel Combustion & Miscellaneous	11.6	13.9	12.8	13.1	14.4	16.0	14.8	15.5
Total	82.4	87.2	83.0	82.3	79.5	77.6	75.3	73.6

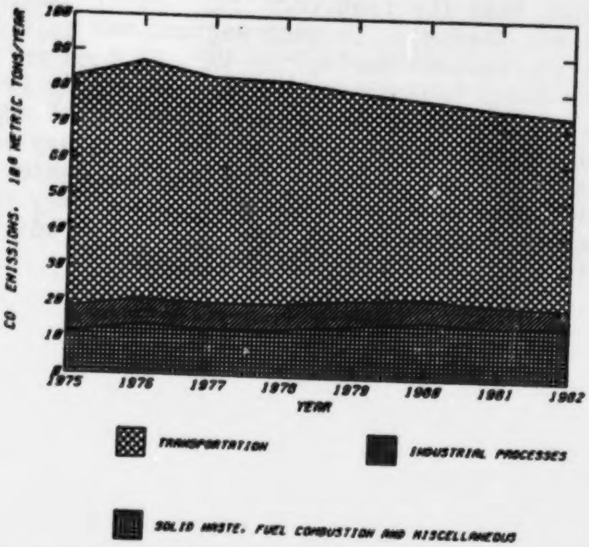


FIGURE 3-17. NATIONAL TREND IN EMISSIONS OF CARBON MONOXIDE. 1975-1982.

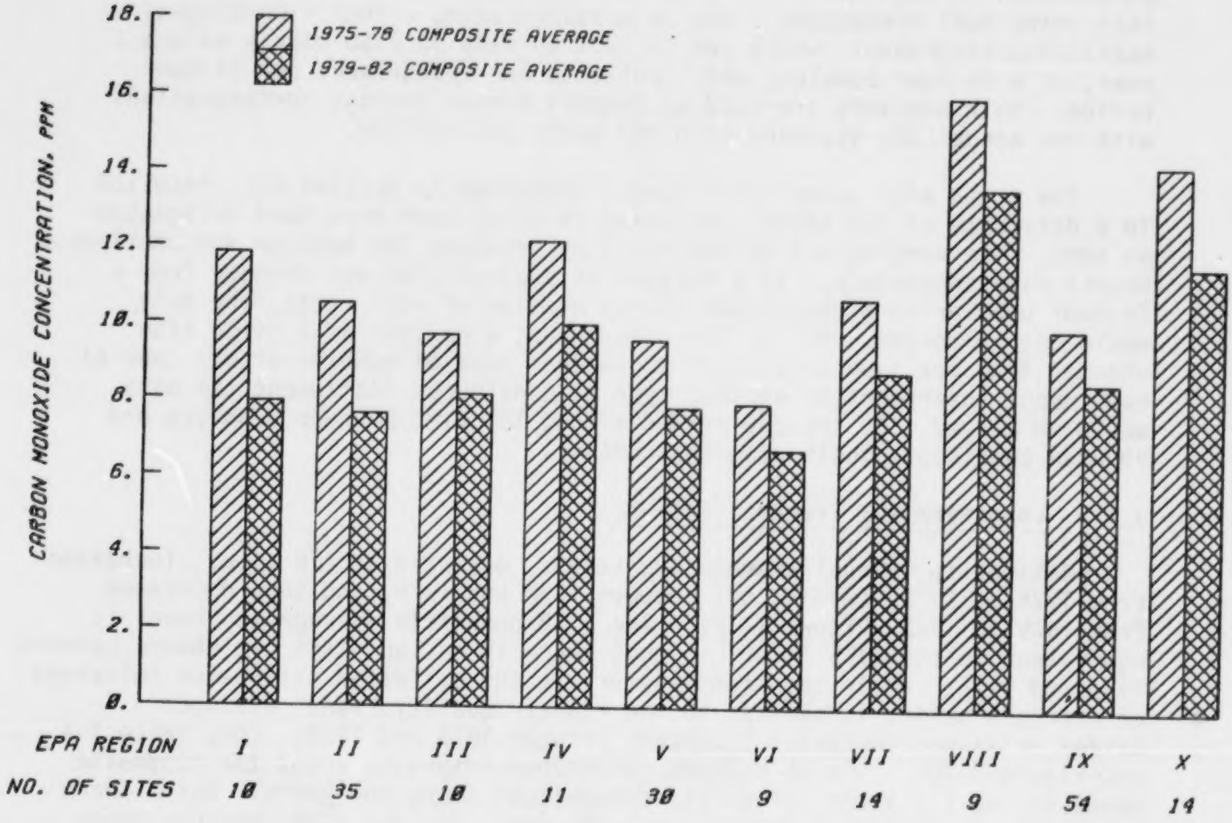


FIGURE 3-18. REGIONAL COMPARISON OF THE 1975-78 AND 1979-82 COMPOSITE AVERAGE OF THE SECOND-HIGHEST NON-OVERLAPPING 8-HOUR CARBON MONOXIDE CONCENTRATION.

3.4 TRENDS IN NITROGEN DIOXIDE

Nitrogen dioxide (NO_2), a yellowish, brown gas, is present in urban atmospheres through emissions from two major sources: transportation and stationary fuel combustion. NO_2 is measured using either a continuous monitoring instrument, which can collect as many as 8760 hourly values a year, or a 24-hour bubbler, which collects one measurement per 24-hour period. Both monitors are used to compare annual average concentrations with the annual NO_2 standard of 0.053 parts per million.

The trend site selection process, discussed in Section 2.1, resulted in a data base of 276 sites, including 14 sites that have been designated as NAMS. The merging was accomplished by treating the bubbler and continuous hourly data separately. If a monitor at a given site was changed from a 24-hour bubbler to a continuous hourly monitor or vice versa, the data would not be merged. If, on the other hand, a monitor at a given site changed from one type of bubbler to another type of bubbler or one type of continuous instrument to another type of continuous instrument the data would be merged. Of the 276 merged sites, 181 used 24-hour bubblers and 95 used continuous monitoring instruments.

3.4.1 Long-term NO_2 Trends: 1975-82

Nationally, annual average NO_2 levels, measured at 276 sites, increased from 1975 to 1978, leveled off between 1978 and 1979, and then decreased from 1979 to 1982 (Figure 3-19). The 1982 composite average NO_2 level is equivalent to the 1975 level, so that there is no long-term net change between 1975 and 1982. While the trend pattern in the estimated nationwide emissions of nitrogen oxides is similar to the NO_2 air quality trend, nitrogen oxides emissions increased 5 percent between 1975 and 1982. (See Table 3-4 and Figure 3-20). The 95 percent confidence intervals about the composite means of the 276 sites, allow for comparisons among the years. While there are no significant differences among the years for the NAMS, because there are so few monitors satisfying the historical trends criteria, there are significant differences among the composite means of the 276 trend sites (Figure 3-19). Although the 1981 and 1982 composite mean NO_2 levels for the 276 sites are not significantly different from one another, they are significantly less than the earlier years 1978, 1979 and 1980. Figure 3-19 illustrates that there has been a statistically significant decrease in NO_2 levels between 1979 and 1982. Figure 3-21 presents this same trend with the use of box-plots. The improvement between 1979 and 1982 can also be seen in the higher concentration levels as reflected in the upper percentiles. The lower percentiles, however, show little or no change. Between 1979 and 1982, both NO_2 and nitrogen oxide emissions showed reductions of 7 and 5 percent, respectively.

3.4.2 Regional Trends

Figure 3-22 shows the regional trends in the annual average NO_2 concentrations at the 276 trend sites. The bar graphs represent the two

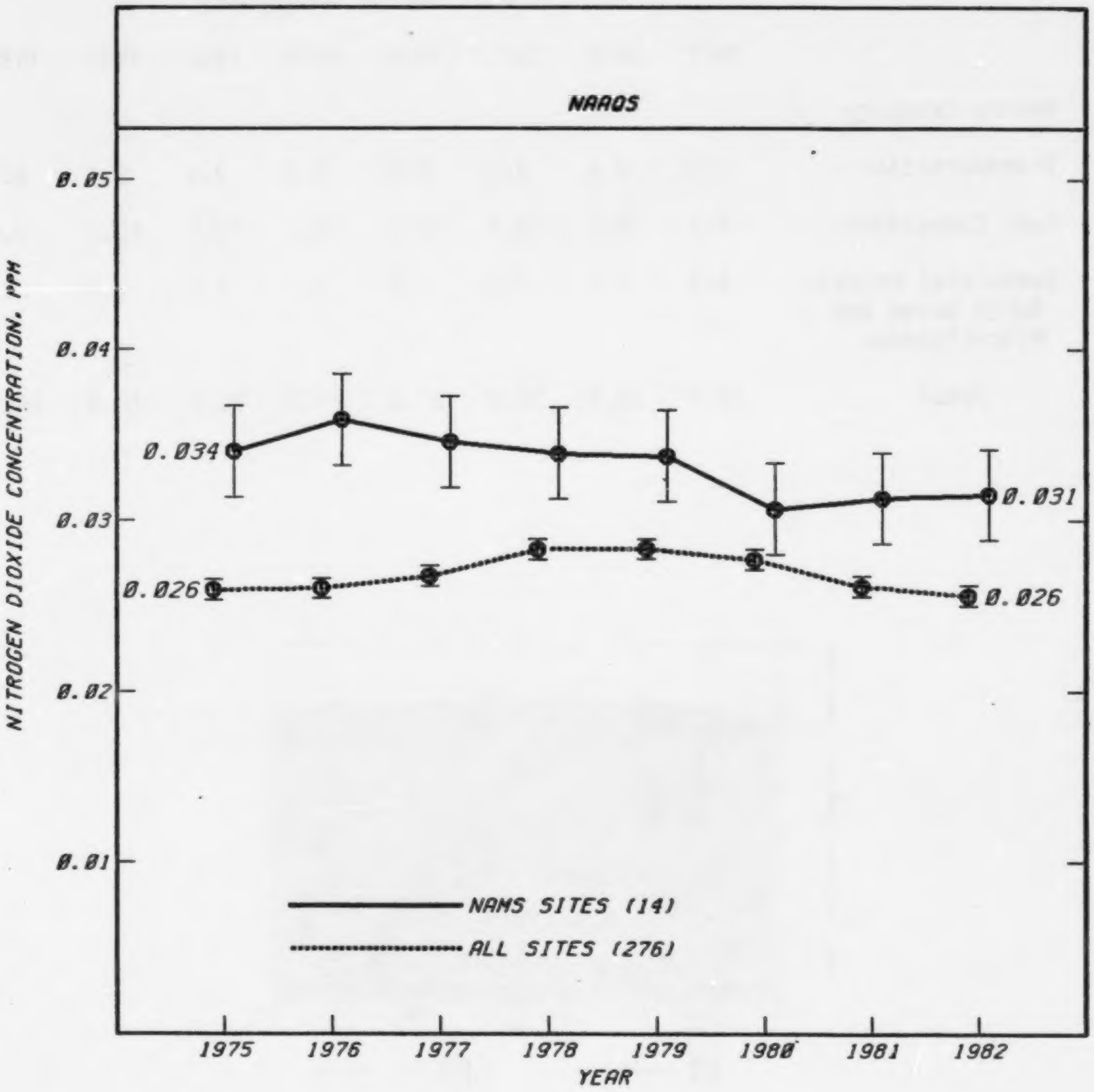


FIGURE 3-19. NATIONAL TREND IN THE COMPOSITE AVERAGE OF NITROGEN DIOXIDE CONCENTRATION AT BOTH NAMS AND ALL SITES WITH 95% CONFIDENCE INTERVALS, 1975 - 1982.

Table 3-4. National Nitrogen Oxide Emission Estimates, 1975-1982.

(10^6 metric tons/year)

Source Category	1975	1976	1977	1978	1979	1980	1981	1982
Transportation	9.0	9.4	9.6	9.9	9.8	9.6	9.7	9.7
Fuel Combustion	9.3	10.0	10.4	10.3	10.5	10.1	10.2	9.6
Industrial Process, Solid Waste and Miscellaneous	0.9	1.0	1.0	1.0	1.0	1.0	1.0	0.9
Total	19.2	20.4	21.0	21.2	21.3	20.7	20.9	20.2

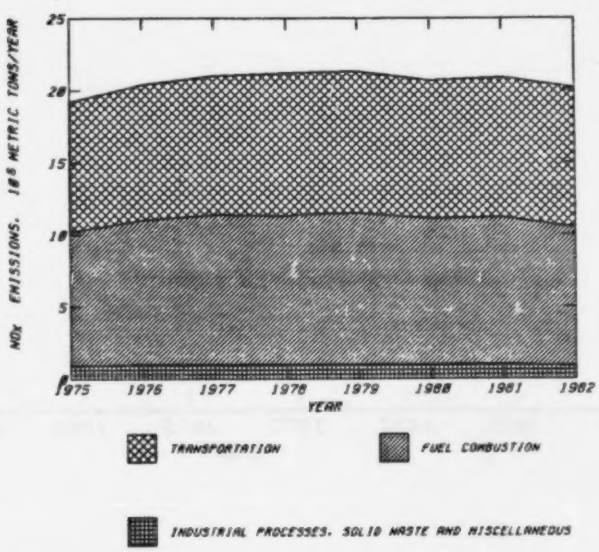


FIGURE 3-20. NATIONAL TREND IN EMISSIONS OF NITROGEN OXIDES. 1975-1982.

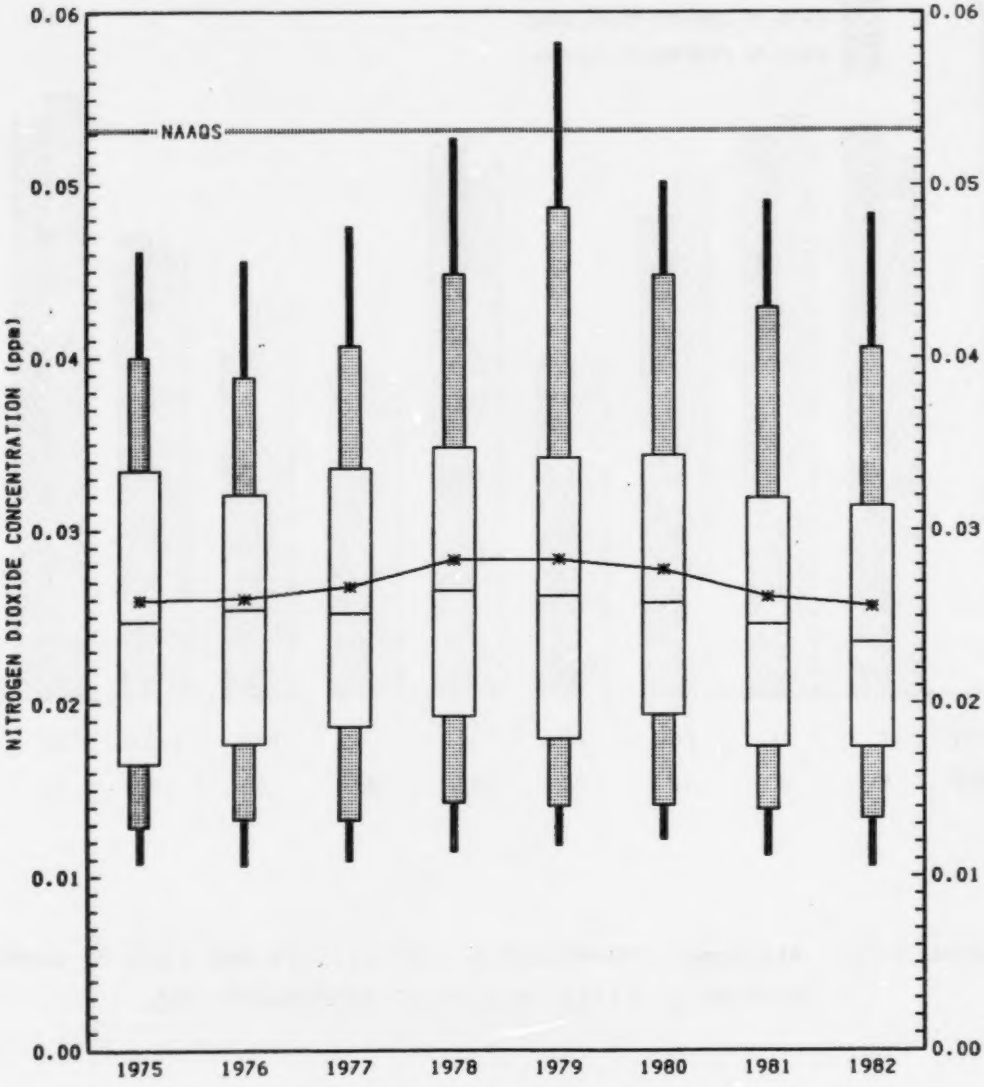


FIGURE 3-21. BOXPLOT COMPARISONS OF TRENDS IN ANNUAL MEAN NITROGEN DIOXIDE CONCENTRATIONS AT 276 SITES, 1975 - 1982.

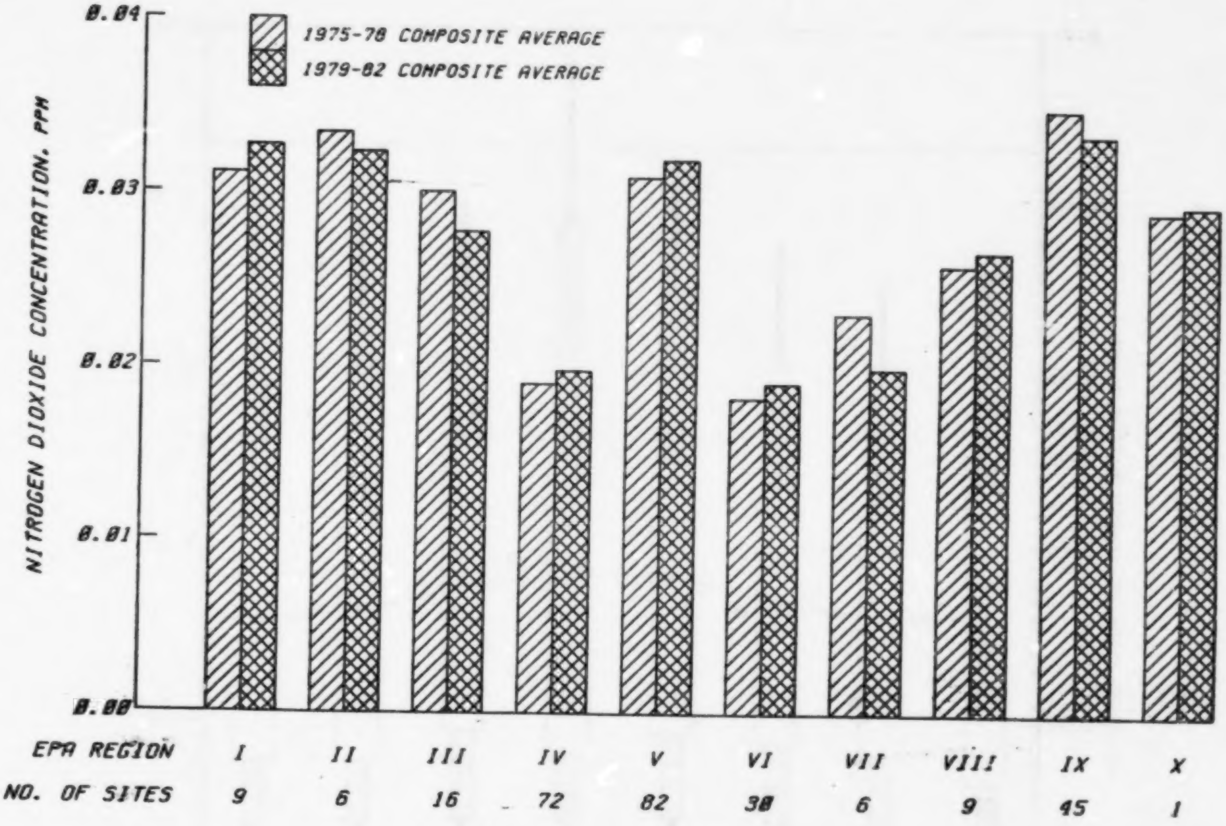


FIGURE 3-22. REGIONAL COMPARISON OF THE 1975-78 AND 1979-82 COMPOSITE AVERAGE OF NITROGEN DIOXIDE CONCENTRATIONS.

time periods: 1975-78 and 1979-82. For all regions the average NO_2 concentrations for both time periods are reasonably close and there is not a predominant pattern of one interval or the other being higher or lower. Six regions show increases in the 1979-82 period while four show decreases. It should be noted that the single site in Region X meeting the trends criteria does not represent the Region but just the air quality at that site.

3.5 TRENDS IN OZONE

The NAAQS for ozone (O_3) is defined in terms of the daily maximum, that is, the highest hourly value for the day, and specifies that the expected number of days per year with values greater than 0.12 ppm should not be greater than one. O_3 is strongly seasonal with higher ambient concentrations usually occurring during the warmer times of the year. Because of this pronounced seasonality, some areas do not monitor the entire year for O_3 but concentrate only on a certain portion of the year which may be termed the O_3 season. The length of this O_3 season varies from one area of the country to another, but May through October is fairly typical with the more southern states and those in the southwest monitoring the entire year while the more northern states would have a shorter season, such as May through September for North Dakota. This trends analysis uses these O_3 seasons on a state by state basis to ensure that the data completeness requirements are applied to the relevant portions of the year.

The trends site selection process discussed in Section 2.1, resulted in a data base of 193 sites for O_3 including 64 sites that have been designated as National Air Monitoring Sites (NAMS). While approximately 25 percent of the sites involved merged data, there was no significant difference in the trends between the sites with merged data and those that did not have merged data.

3.5.1 LONG-TERM OZONE TRENDS: 1975-82

The composite average trend for the second high day during the O_3 season is shown in Figure 3-23 for the 193 trend sites and the subset of 64 NAMS. Although the graph indicates an overall decrease of 18 percent between 1975 and 1982, the pattern shows fairly consistent levels from 1975 through 1978 followed by a drop between 1978 and 1979. As noted previously, this decrease between 1978 and 1979 may be partly attributable to the change in calibration procedure recommended by EPA in June 1978.[13] Because it is difficult to quantify the exact percentage of the 1978-79 decrease that is attributable to the calibration change, some caution is warranted in interpreting the results across this 1978-79 drop. However, the results do indicate that while there was little change during the 1975-78 period there has been recent improvement with the 1981-82 levels being less than 1979-80 as shown by the confidence intervals for the national samples. The box-plot presentation of this trend is presented in Figure 3-24 and also shows that 1981-82 levels were generally lower than those in 1979-80.

The composite trend in the estimated number of exceedances of the O_3 standard level of 0.12 ppm is shown in Figure 3-25. This graph is also affected by the calibration change between 1978 and 1979, but it does illustrate that for the national sample the 1982 average is significantly less than those in 1979 and 1980. Overall, the estimated number of exceedances during the ozone season decreased 49 percent between 1975 and 1982.

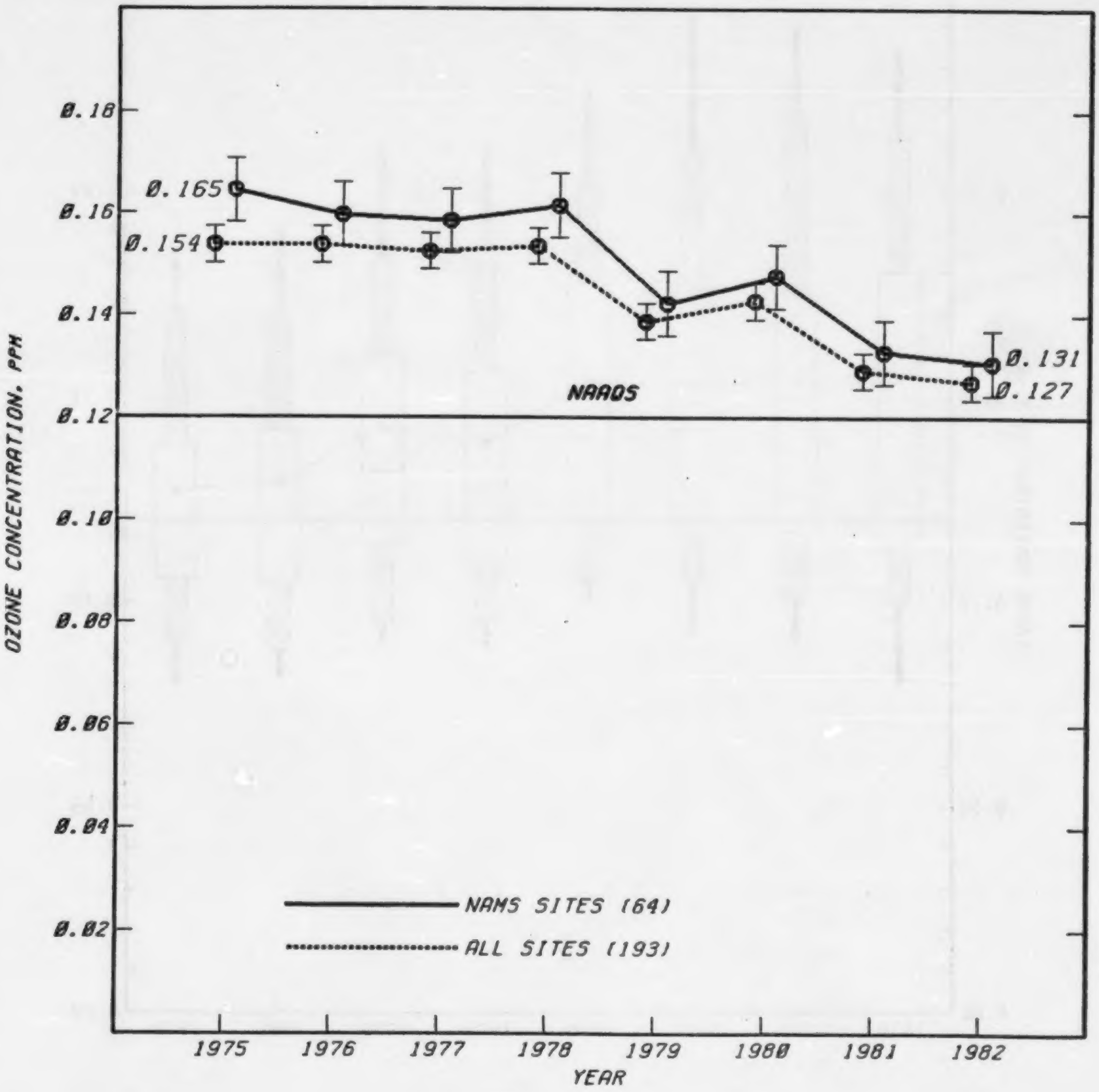


FIGURE 3-23. NATIONAL TREND IN THE COMPOSITE AVERAGE OF THE SECOND HIGHEST DAILY MAXIMUM 1-HOUR OZONE CONCENTRATION AT BOTH NAMS AND ALL SITES WITH 95% CONFIDENCE INTERVALS, 1975 - 1982.

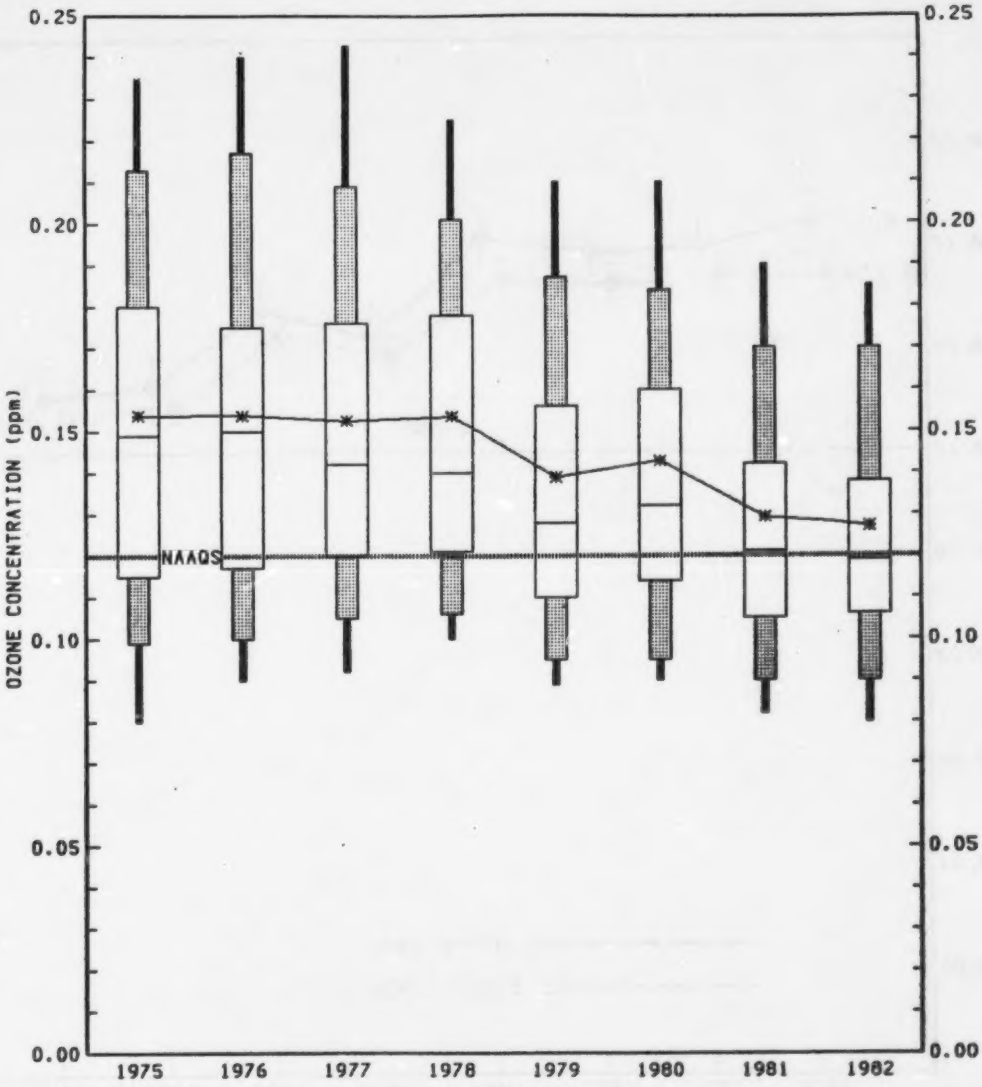


FIGURE 3-24. BOXPLOT COMPARISONS OF TRENDS IN ANNUAL SECOND HIGHEST DAILY MAXIMUM 1-HOUR OZONE CONCENTRATIONS AT 193 SITES, 1975 - 1982.

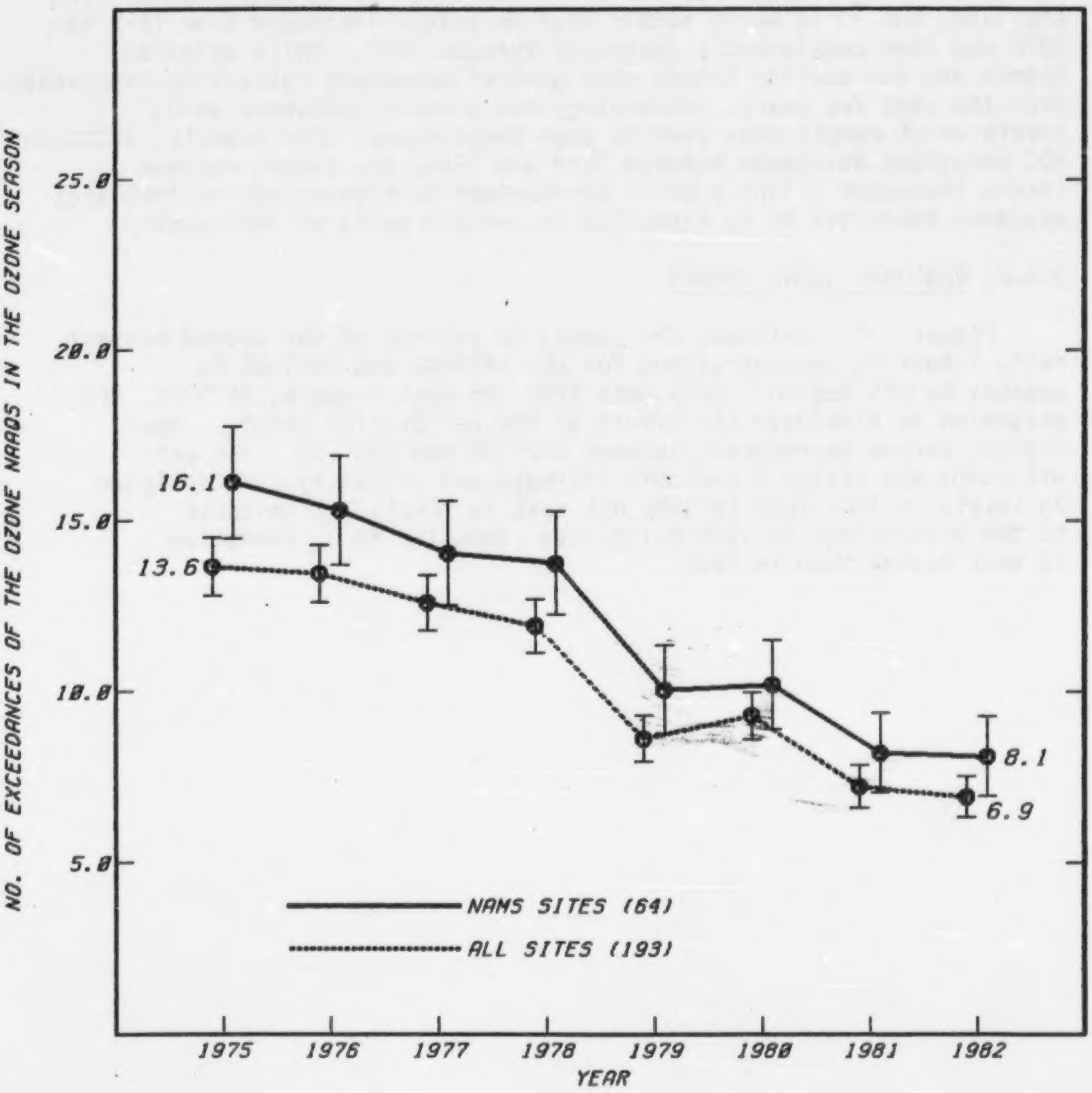


FIGURE 3-25. NATIONAL TREND IN THE COMPOSITE AVERAGE OF THE ESTIMATED NUMBER OF DAILY EXCEEDANCES OF THE OZONE NAAQS IN THE OZONE SEASON AT BOTH NAMS AND ALL SITES WITH 95% CONFIDENCE INTERVALS, 1975 - 1982.

Table 3-5 and Figure 3-26 display the emission trends for Volatile Organic Compounds (VOC) which, along with nitrogen oxides, are involved in the atmospheric chemical and physical processes that result in the formation of O_3. Total VOC emissions decreased 13 percent between 1975 and 1982, but it is worth noting that emissions increased from 1975 to 1978 and then consistently decreased through 1982. While emission trends and air quality trends show general agreement reflecting improvement over the past few years, meteorology has a major influence on O_3 levels which complicates year to year comparisons. For example, although VOC emissions decreased between 1979 and 1980, the second maximum O_3 levels increased slightly which corresponds to meteorology in 1980 that was more conducive to O_3 formation in certain parts of the country.

3.5.2 REGIONAL OZONE TRENDS

Figure 3-27 contrasts the composite average of the second highest daily 1-hour O_3 concentrations for the 1979-80 and 1981-82 O_3 seasons by EPA Region. Only data from the last 4 years, 1979-82, are presented to eliminate the effect of the calibration change. Most Regions showed improvement between 1979-80 and 1981-82. The only exception was Region X and this increase was primarily due to higher O_3 levels in 1981 than in 1980 but this is likely attributable to the meteorology in 1980 being less condusive to O_3 formation in that Region than in 1981.

Table 3-5. National Volatile Organic Compound Oxide Emission Estimates, 1975-1982.

(10^6 metric tons/year)

Source Category	1975	1976	1977	1978	1979	1980	1981	1982
Transportation	8.6	8.7	8.3	8.0	7.3	6.7	6.4	6.1
Industrial Process	8.1	8.7	9.0	9.6	9.5	8.9	8.0	7.1
Solid Waste and Miscellaneous	2.4	2.8	2.7	2.9	3.1	3.3	3.4	3.5
Industrial Organic Solvent	1.9	1.9	1.9	1.9	2.0	1.9	1.6	1.5
Total	21.0	22.1	21.9	22.4	21.9	20.8	19.4	18.2

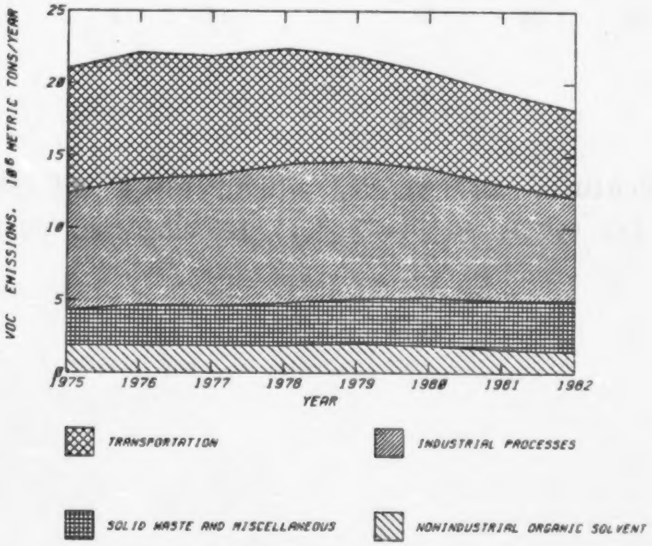


FIGURE 3-26. NATIONAL TREND IN EMISSIONS OF VOLATILE ORGANIC COMPOUNDS, 1975-1982.

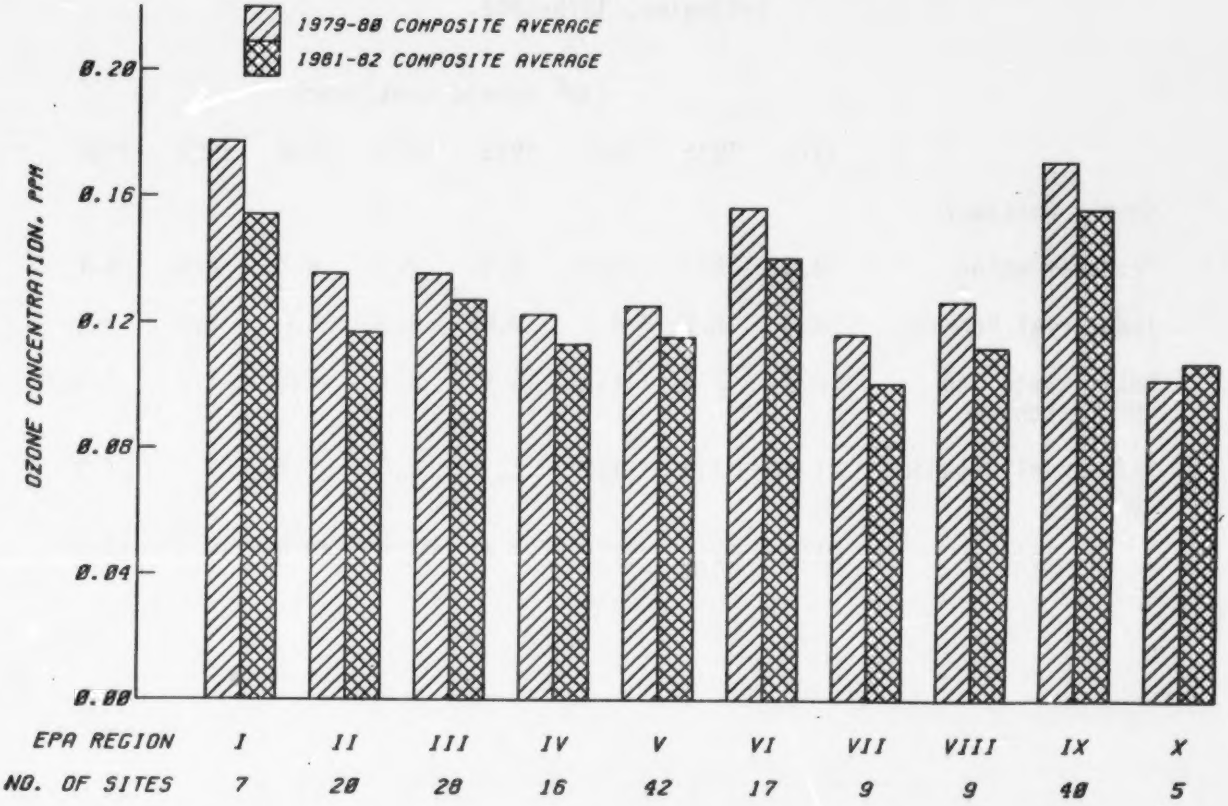


FIGURE 3-27. REGIONAL COMPARISON OF THE 1979-80 AND 1981-82 COMPOSITE AVERAGE OF THE SECOND-HIGHEST DAILY 1-HOUR OZONE CONCENTRATION.

3.6 TRENDS IN LEAD

Lead (Pb) gasoline additives, non-ferrous smelters, and battery plants are the most significant contributors to atmospheric lead emissions. Transportation sources alone contribute about 80 percent of the annual emissions.

Prior to promulgation of the lead standard in October 1978,[14] two air pollution control programs were implemented by EPA that have resulted in lower ambient lead levels. First, regulations, were issued in the early 1970's which required the lead content of all gasoline to be gradually reduced over a period of many years. Second, as part of EPA's overall automotive emission control program, unleaded gasoline was introduced in 1975 for use in automobiles equipped with catalytic control devices which reduced emissions of carbon monoxide, hydrocarbons and nitrogen oxides. The overall effect of these two control programs has been a major reduction in both the amount of lead in gasoline and in ambient levels.

3.6.1 Long-term Lead Trends, 1975-82

Previous trend analyses of ambient Pb data[15,16] were based almost exclusively on National Air Surveillance Network (NASN) sites. These sites were established in the 1960's to monitor ambient air quality levels of TSP and associated trace metals, including lead. The sites were predominantly located in the central business districts of larger American cities. In October 1980, new ambient Pb monitoring regulations were promulgated.[17] The siting criteria in the regulations resulted in the elimination of many of the old historic TSP monitoring sites as being suitable sites for the measurement of ambient Pb concentrations.

As with the other pollutants the trend sites that were selected had to satisfy an annual data completeness criterion of at least 6 out of 8 years in the 1975 to 1982 time period. A year was included as "valid" if at least 3 of the 4 quarterly averages were available. A total of only 46 urban-oriented sites, representing just six states, met the data completeness criteria.

The composite maximum quarterly averages and their respective 95 percent confidence intervals are shown in Figure 3-28 for both 46 urban sites (1975-1982) and 214 sites (1979-1982). There was a 64 percent overall (1975-82) percentage decrease. The confidence intervals indicate that the 1975-78 averages are significantly different from the 1980-82 averages. The box plots are shown in Figure 3-29 for the 46 sites. The upper percentile points (75 and 90th) exhibit a somewhat different pattern than the mean or median; however, the overall decrease is still evident. On the other hand the lower percentile points (10 and 25th) do not show a definite pattern and, primarily, reflect sites located in Texas.

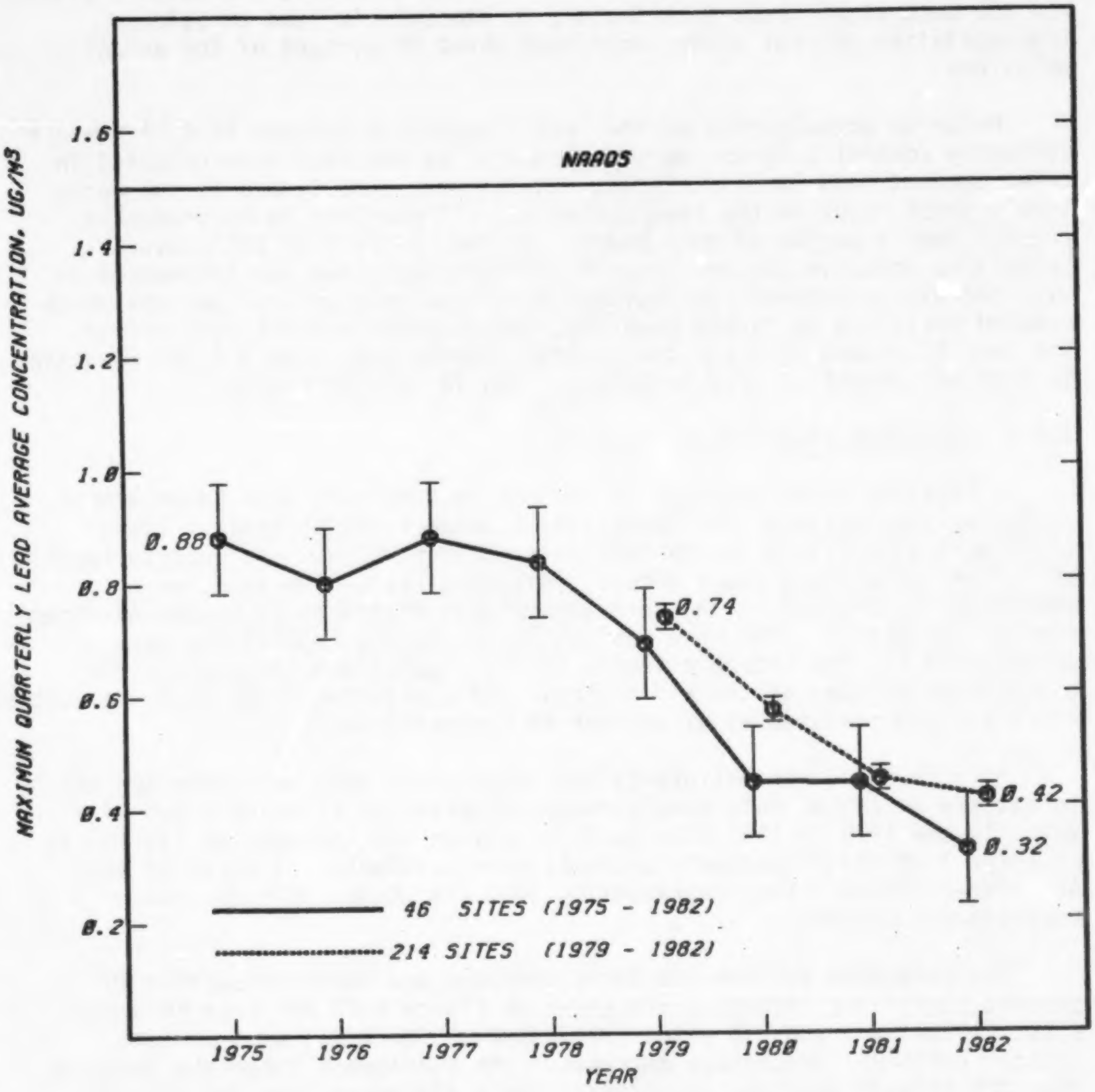


FIGURE 3-28. NATIONAL TREND IN MAXIMUM QUARTERLY AVERAGE LEAD LEVELS WITH 95% CONFIDENCE INTERVALS AT 46 SITES (1975 - 1982) AND 214 SITES (1979 - 1982).

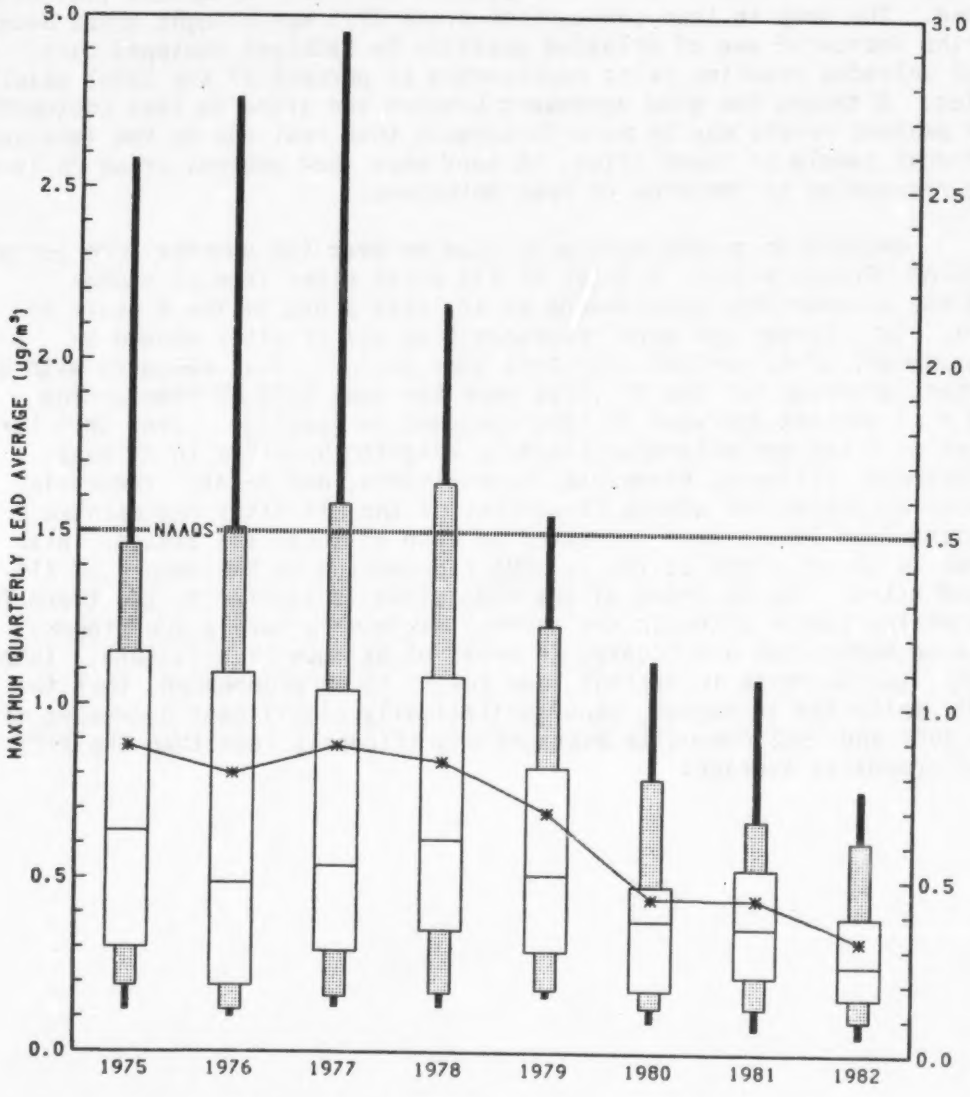


FIGURE 3-29. BOXPLOT COMPARISONS OF TRENDS IN MAXIMUM QUARTERLY LEAD LEVELS AT 46 SITES, 1975 - 1982.

The 1975-82 trend in lead consumed in gasoline, based on information from the Ethyl Corporation[18] and the Department of Energy,[19] is shown in Figure 3-30. The overall percentage decrease for lead consumption was 69 percent. This compares with a 64 percent decrease in ambient lead noted above. The drop in lead consumption since 1975 was brought about because of the increased use of unleaded gasoline in catalyst equipped cars. In 1982 unleaded gasoline sales represented 51 percent of the total gasoline sales. Although the good agreement between the trend in lead consumption and ambient levels may be more fortuitous than real due to the imbalanced national sample of trend sites, it does show that ambient urban Pb levels are responding to the drop in lead emissions.

Ambient Pb trends were also studied over the shorter term period 1979-82 (Figure 3-31). A total of 214 urban sites from 21 states met the minimum data requirement of at least 3 out of the 4 years of data. This larger and more representative set of sites showed an improvement of 43 percent over this time period. This compares with a 54 percent decrease for the 46 sites over the same 1979-82 time period and a 61 percent decrease in lead consumed in gasoline. Even this larger group of sites was disproportionately weighted by sites in Arizona, California, Illinois, Minnesota, Pennsylvania, and Texas. These six states accounted for almost 79 percent of the 214 sites represented. Ambient lead levels have decreased in each of these six states. Also shown is the Pb trend at the 10 NAMS represented in the sample of 214 trend sites. The Pb trend at the NAMS sites is similar to the trend for the entire sample although the average maximum Pb levels are higher, because NAMS sites are located in areas of maximum Pb emissions. Interestingly, the decrease in ambient lead levels is so pronounced, that the 10 NAMS, while few in number, show statistically significant decreases with the 1981 and 1982 composite averages significantly less than the 1979 and 1980 composite averages.

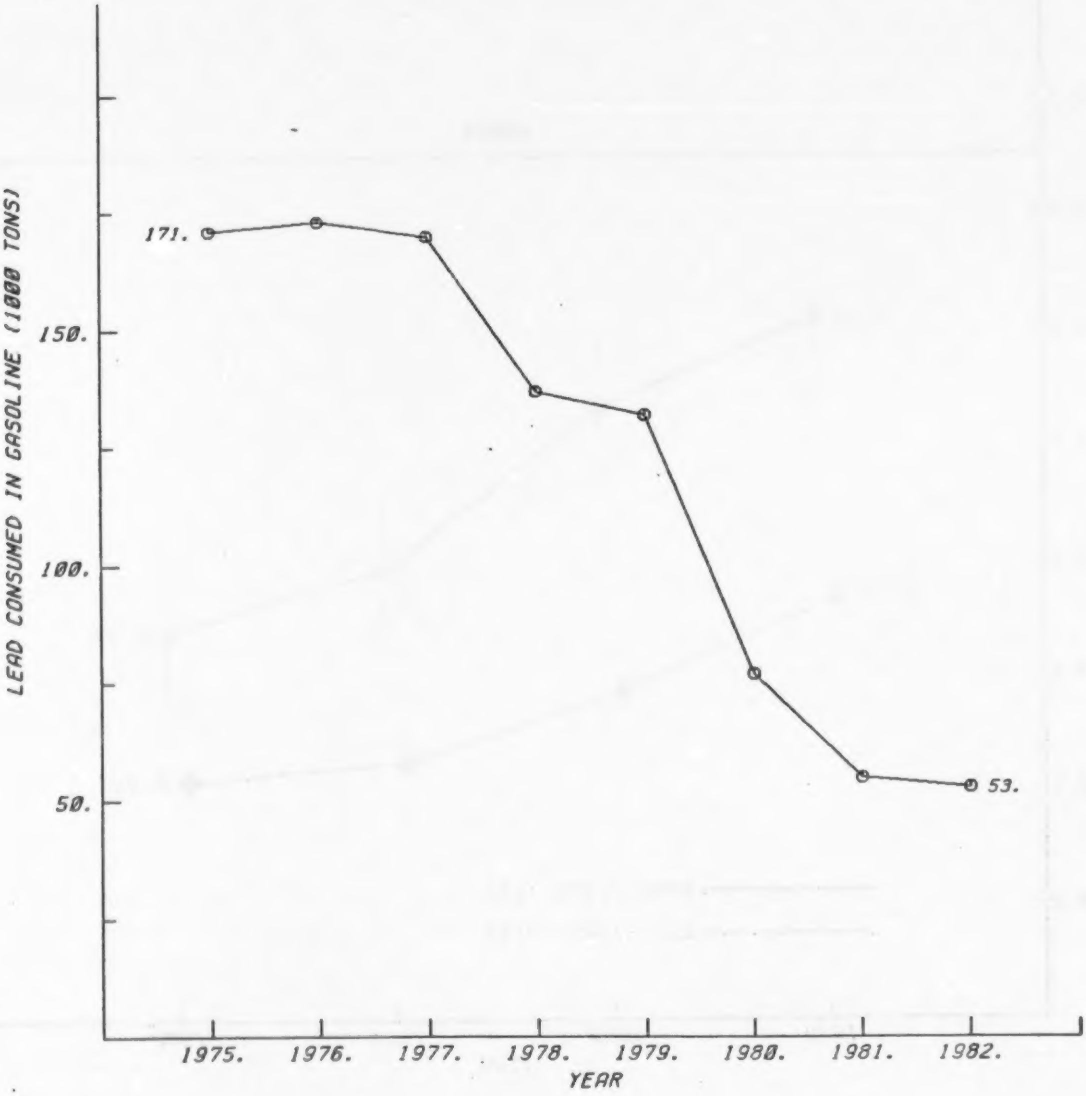


FIGURE 3-30. LEAD CONSUMED IN GASOLINE, 1975 - 1982.

(SALES TO THE MILITARY EXCLUDED)

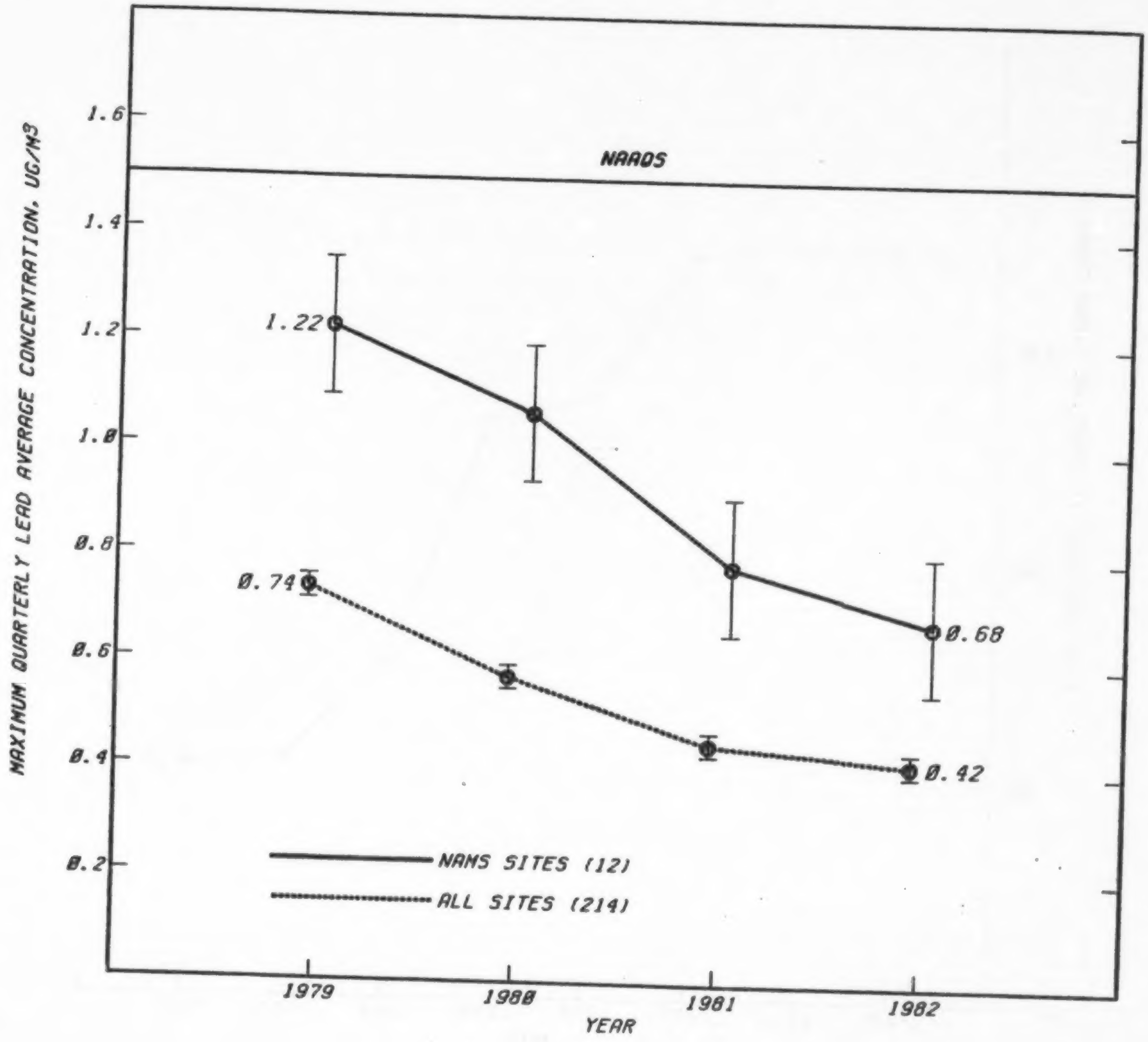


FIGURE 3-31. NATIONAL TREND IN MAXIMUM QUARTERLY AVERAGE LEAD LEVELS WITH 95% CONFIDENCE INTERVALS AT BOTH NAMS AND ALL SITES, 1979 - 1982.

3.7 References

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17. Federal Register, Vol. 45, October 10, 1980, pp 67564-67575.

18. Yearly Report of Gasoline Sales by States, 1982, Ethyl Corporation, 2 Houston Center, Suite 900, Houston, Texas 77010.

19. Sheldon, Ella Mae, Motor Gasolines, Winter 1981, U. S. Department of Energy, Bartlesville Energy Technology Center, Bartlesville, Oklahoma Publication No. DOE/BETC/PPS-81/3.

4. AIR QUALITY LEVELS IN STANDARD METROPOLITAN STATISTICAL AREAS

The Tables in this section summarize air quality by Standard Metropolitan Statistical Area (SMSA) for SMSA's with populations greater than 500,000. The air quality statistics relate to pollutant-specific NAAQS. The purpose of these summaries is to provide the reader with information on how air quality varies among SMSA's and from year-to-year. The higher air quality levels measured in the SMSA are summarized for the years 1980, 1981 and 1982.

The reader should be cautioned that these summaries are not sufficient in themselves to adequately rank or compare the SMSA's according to their air quality. To properly rank the air pollution severity in different SMSA(s), data on population characteristics, daily population mobility, transportation patterns, industrial composition, emission inventories, meteorological factors and, most important, the spatial representativeness of the monitoring sites would also be needed.

The same annual data completeness criterion used in the air quality trends data base was used here for the calculation of annual means. (See Section 2.1). If some data has been collected at one or more sites, but none of these sites meet the annual data completeness criteria, then the reader will be advised that there is insufficient data to calculate the annual mean.

With respect to the summary statistics for air quality levels with averaging times less than or equal to 24-hours, measured with continuous monitoring instruments, a footnote will be placed next to the level if the volume of annual data is less than 4380 hours for CO, less than 183 days for SO_2 or less than 50 percent of the days during the ozone season for ozone, which varies by state.[1] For example, in California the ozone season is defined as 12 months, January through December, while in New Jersey it is defined as 7 months, April through October.

4.1 SUMMARY STATISTICS

In the following SMSA summaries, the air quality levels reported are the highest levels measured within the SMSA(s). The pollutant-specific statistics reported are summarized in Table 4-1, along with their associated primary NAAQS concentrations. For example, if an SMSA has three ozone monitors in 1981 with second highest daily hourly maxima of .15 ppm, .14 ppm and .12 ppm, the highest of these, .15 ppm, would be reported for that SMSA for 1981.

In the case of Pb, the quarterly average is either based on as many as 15 24-hour measurements or one or more chemical composite measurements. Most of the maximum quarterly Pb averages are based on multiple 24-hour measurements. If the maximum quarterly average is based on a chemical composite, it is footnoted accordingly.

Table 4-1. Air Quality Summary Statistics and Their Associated National Ambient Air Quality Standards (NAAQS)

POLLUTANT	STATISTICS	PRIMARY NAAQS CONCENTRATION
Total Suspended Particulate	annual geometric mean	75 ug/m^3
Sulfur Dioxide	annual arithmetic mean	0.03 ppm
	second highest 24-hour average	0.14 ppm
Carbon Monoxide	second highest nonoverlapping 8-hour average	9 ppm
Nitrogen Dioxide	annual arithmetic mean	0.053 ppm
Ozone	second highest daily maximum 1-hour average	0.12 ppm
Lead	maximum quarterly average	1.5 ug/m^3

ug/m^3 = micrograms per cubic meter

ppm = parts per million

4.2 AIR QUALITY SMSA COMPARISONS

In each of the following SMSA air quality summaries, the SMSA's are grouped according to population starting with the largest SMSA - New York, NY-NJ and continuing to the smallest SMSA with a population in excess of 500,000, Long Branch - Asbury Park, NJ. The population groupings and the number of SMSA's contained within each are as follows: 16 SMSA's have populations in excess of 2 million, 23 SMSA's have populations between 1 and 2 million and 41 SMSA's have populations between 0.5 and 1 million. The population statistics are based on the 1980 census.

The air quality summary statistics are summarized in the following tables:

Table 4-2. Highest Annual Geometric Mean Suspended Particulate Concentration by SMSA, 1980-82.

Table 4-3. Highest Annual Arithmetic Mean Sulfur Dioxide Concentration by SMSA, 1980-82.

Table 4-4. Highest Second Maximum 24-hour Average Sulfur Dioxide Concentration by SMSA, 1980-82.

Table 4-5. Highest Second Maximum Nonoverlapping 8-hour Average Carbon Monoxide Concentration by SMSA, 1980-82.

Table 4-6. Highest Annual Arithmetic Mean Nitrogen Dioxide Concentration by SMSA, 1980-82.

Table 4-7. Highest Second Daily Maximum 1-hour Average Ozone Concentration by SMSA, 1980-82.

Table 4-8. Highest Maximum Quarterly Average Lead Concentration by SMSA, 1980-82.

The air quality summaries follow:

4.3 REFERENCES

1. Rhoads, Richard G., U. S. Environmental Protection Agency, memorandum to Director of the Environmental Services Divisions and Air and Waste Management Divisions, EPA Regions I through X, 15 December 1982.

TABLE 4-2

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 11/25/83 SUSPENDED PARTICULATE CONCENTRATION BY SMSA POPULATION RANGE PAGE NO: 1

STANDARD METROPOLITAN STATISTICAL AREA	SUSPENDED PARTICULATE CONCENTRATION (UG/M3) HIGHEST ANNUAL GEOMETRIC MEAN 1980	1981	1982
POPULATION: > 2 MILLION			
NEW YORK, NY-NJ	68	68	59
LOS ANGELES-LONG BEACH, CA	123	121	84
CHICAGO, IL	118	111	86
PHILADELPHIA, PA-NJ	75	82	68
DETROIT, MI	138	116	112
SAN FRANCISCO-OAKLAND, CA	66	56	53
WASHINGTON, DC-MD-VA	67	65	53
DALLAS-FORT WORTH, TX	77	77	78
HOUSTON, TX	159	151	133
BOSTON, MA	74	62	71
NASSAU-SUFFOLK, NY	59	56	54
ST. LOUIS, MO-IL	167	190	134
PITTSBURGH, PA	115	100	65

NOTE: THE ANNUAL GEOMETRIC MEAN IS CALCULATED IF THE DATA COLLECTED SATISFIES THE NADB VALIDITY CRITERIA OR AT LEAST 30 DAYS OF 24-HR DATA (50% OF THE EPA RECOMMENDED SAMPLING DAYS) HAVE BEEN COLLECTED.
ND = NO DATA
IN = INSUFFICIENT DATA TO CALCULATE THE ANNUAL GEOMETRIC MEAN

TABLE 4-2

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 11/25/83 SUSPENDED PARTICULATE CONCENTRATION BY SMSA POPULATION RANGE PAGE NO: 2

STANDARD METROPOLITAN STATISTICAL AREA	SUSPENDED PARTICULATE CONCENTRATION (UG/M3) HIGHEST ANNUAL GEOMETRIC MEAN 1980	1981	1982
POPULATION: > 2 MILLION (CONT)			
BALTIMORE, MD	90	90	72
MINNEAPOLIS-ST. PAUL, MN-WI	114	100	73
ATLANTA, GA	65	79	63
TOTAL SMSA'S > 2 MILLION : 16			

NOTE: THE ANNUAL GEOMETRIC MEAN IS CALCULATED IF THE DATA COLLECTED SATISFIES THE NADB VALIDITY CRITERIA OR AT LEAST 30 DAYS OF 24-HR DATA (50% OF THE EPA RECOMMENDED SAMPLING DAYS) HAVE BEEN COLLECTED.
ND = NO DATA
IN = INSUFFICIENT DATA TO CALCULATE THE ANNUAL GEOMETRIC MEAN

TABLE 4-2

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 11/25/83 SUSPENDED PARTICULATE CONCENTRATION BY SMSA POPULATION RANGE PAGE NO: 3

STANDARD METROPOLITAN STATISTICAL AREA	SUSPENDED PARTICULATE CONCENTRATION (UG/M3) HIGHEST ANNUAL GEOMETRIC MEAN 1980	1981	1982
POPULATION: 1 - 2 MILLION			
NEWARK, NJ	84	95	72
ANAHEIM-SANTA ANA-GARDEN GROVE, CA	100	104	86
CLEVELAND, OH	148	129	101
SAN DIEGO, CA	95	95	76
MIAMI, FL	84	97	48
DENVER-BOULDER, CO	199	183	169
SEATTLE-EVERETT, WA	84	87	74
TAMPA-ST. PETERSBURG, FL	89	82	57
RIVERSIDE-SAN BERNARDINO-ONTARIO, CA	197	157	102
PHOENIX, AZ	177	178	140
CINCINNATI, OH-KY-IN	110	84	78
MILWAUKEE, WI	102	73	62
KANSAS CITY, MO-KS	113	96	71

NOTE: THE ANNUAL GEOMETRIC MEAN IS CALCULATED IF THE DATA COLLECTED SATISFIES THE NADB VALIDITY CRITERIA OR AT LEAST 30 DAYS OF 24-HR DATA (50% OF THE EPA RECOMMENDED SAMPLING DAYS) HAVE BEEN COLLECTED.
ND = NO DATA
IN = INSUFFICIENT DATA TO CALCULATE THE ANNUAL GEOMETRIC MEAN

TABLE 4-2

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 11/25/83 SUSPENDED PARTICULATE CONCENTRATION BY SMSA POPULATION RANGE PAGE NO: 4

STANDARD METROPOLITAN STATISTICAL AREA	SUSPENDED PARTICULATE CONCENTRATION (UG/M3) HIGHEST ANNUAL GEOMETRIC MEAN 1980	1981	1982
POPULATION: 1 - 2 MILLION (CONT)			
SAN JOSE, CA	76	64	53
BUFFALO, NY	109	97	82
PORTLAND, OR-WA	159	114	88
NEW ORLEANS, LA	72	82	63
INDIANAPOLIS, IN	82	80	67
COLUMBUS, OH	78	74	68
SAN JUAN, PR	96	94	81
SAN ANTONIO, TX	90	73	100
FORT LAUDERDALE-HOLLYWOOD, FL	66	69	48
SACRAMENTO, CA	74	68	55

TOTAL SMSA'S 1 - 2 MILLION : 23

NOTE: THE ANNUAL GEOMETRIC MEAN IS CALCULATED IF THE DATA COLLECTED SATISFIES THE NADB VALIDITY CRITERIA OR AT LEAST 30 DAYS OF 24-HR DATA (50% OF THE EPA RECOMMENDED SAMPLING DAYS) HAVE BEEN COLLECTED.

ND = NO DATA

IN = INSUFFICIENT DATA TO CALCULATE THE ANNUAL GEOMETRIC MEAN

TABLE 4-2

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 11/25/83 SUSPENDED PARTICULATE CONCENTRATION BY SMSA POPULATION RANGE PAGE NO: 5

STANDARD METROPOLITAN STATISTICAL AREA	SUSPENDED PARTICULATE CONCENTRATION (UG/M3) HIGHEST ANNUAL GEOMETRIC MEAN 1980	1981	1982
POPULATION: .5 - 1 MILLION			
ROCHESTER, NY	63	73	88
SALT LAKE CITY-OGDEN, UT	77	67	68
PROVIDENCE-WARWICK-PAWTUCKET, RI-MA	78	57	56
MEMPHIS, TN-AR-MS	84	74	67
LOUISVILLE, KY-IN	100	92	75
NASHVILLE-DAVIDSON, TN	80	74	59
BIRMINGHAM, AL	114	111	84
OKLAHOMA CITY, OK	85	96	86
DAYTON, OH	92	77	60
GREENSBORO-WINSTON-SALEM-HIGH POINT, NC	90	61	54
NORFOLK-VIRGINIA BEACH-PORTSMOUTH, VA-NC	78	64	53
ALBANY-SCHENECTADY-TROY, NY	65	59	55
TOLEDO, OH-MI	81	72	69

NOTE: THE ANNUAL GEOMETRIC MEAN IS CALCULATED IF THE DATA COLLECTED SATISFIES THE NADB VALIDITY CRITERIA OR AT LEAST 30 DAYS OF 24-HR DATA (50% OF THE EPA RECOMMENDED SAMPLING DAYS) HAVE BEEN COLLECTED.
ND = NO DATA
IN = INSUFFICIENT DATA TO CALCULATE THE ANNUAL GEOMETRIC MEAN

TABLE 4-2

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 11/25/83 SUSPENDED PARTICULATE CONCENTRATION BY SMSA POPULATION RANGE PAGE NO: 6

STANDARD METROPOLITAN STATISTICAL AREA	SUSPENDED PARTICULATE CONCENTRATION (UG/M3) HIGHEST ANNUAL GEOMETRIC MEAN 1980	1981	1982
POPULATION: .5 - 1 MILLION (CONT)			
HONOLULU, HI	53	51	46
JACKSONVILLE, FL	68	79	74
HARTFORD, CT	55	47	48
ORLANDO, FL	55	67	50
TULSA, OK	130	99	88
AKRON, OH	81	67	67
GARY-HAMMOND-EAST CHICAGO, IN	250	121	90
SYRACUSE, NY	67	76	68
NORTHEAST PENNSYLVANIA	80	61	50
CHARLOTTE-GASTONIA, NC	70	67	62
ALLENTOWN-BETHLEHEM-EASTON, PA-NJ	97	84	68
RICHMOND, VA	70	50	45
GRAND RAPIDS, MI	57	58	49

NOTE: THE ANNUAL GEOMETRIC MEAN IS CALCULATED IF THE DATA COLLECTED SATISFIES THE NADB VALIDITY CRITERIA OR AT LEAST 30 DAYS OF 24-HR DATA (50% OF THE EPA RECOMMENDED SAMPLING DAYS) HAVE BEEN COLLECTED.
ND = NO DATA
IN = INSUFFICIENT DATA TO CALCULATE THE ANNUAL GEOMETRIC MEAN

TABLE 4-2

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 11/25/83 SUSPENDED PARTICULATE CONCENTRATION BY SMSA POPULATION RANGE PAGE NO: 7

STANDARD METROPOLITAN STATISTICAL AREA	SUSPENDED PARTICULATE CONCENTRATION (UG/M3) HIGHEST ANNUAL GEOMETRIC MEAN 1980	1981	1982
POPULATION: .5 - 1 MILLION (CONT)			
NEW BRUNSWICK-PERTH AMBOY-SAYREVILLE, NJ	76	69	60
WEST PALM BEACH-BOCA RATON, FL	57	59	45
OMAHA, NE-IA	106	91	64
GREENVILLE-SPARTANBURG, SC	64	63	52
JERSEY CITY, NJ	100	86	75
AUSTIN, TX	50	78	64
YOUNGSTOWN-WARREN, OH	110	96	84
TUCSON, AZ	117	112	93
RALEIGH-DURHAM, NC	63	53	45
SPRINGFIELD-CHICOPEE-HOLYOKE, MA-CT	65	73	51
OXNARD-SIMI VALLEY-VENTURA, CA	93	90	64
WILMINGTON, DE-NJ-MD	69	65	53
FLINT, MI	80	60	51

NOTE: THE ANNUAL GEOMETRIC MEAN IS CALCULATED IF THE DATA COLLECTED SATISFIES THE NADB VALIDITY CRITERIA OR AT LEAST 30 DAYS OF 24-HR DATA (50% OF THE EPA RECOMMENDED SAMPLING DAYS) HAVE BEEN COLLECTED.
ND = NO DATA
IN = INSUFFICIENT DATA TO CALCULATE THE ANNUAL GEOMETRIC MEAN

TABLE 4-2

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 11/25/83 SUSPENDED PARTICULATE CONCENTRATION BY SMSA POPULATION RANGE PAGE NO: 8

STANDARD METROPOLITAN STATISTICAL AREA	SUSPENDED PARTICULATE CONCENTRATION (UG/M3) HIGHEST ANNUAL GEOMETRIC MEAN 1980	1981	1982
POPULATION: .5 - 1 MILLION (CONT)			
FRESNO, CA	114	109	96
LONG BRANCH-ASBURY PARK, NJ	58	62	45
TOTAL SMSA'S .5 - 1 MILLION 41			

NOTE: THE ANNUAL GEOMETRIC MEAN IS CALCULATED IF THE DATA COLLECTED SATISFIES THE NADB VALIDITY CRITERIA OR AT LEAST 30 DAYS OF 24-HR DATA (50% OF THE EPA RECOMMENDED SAMPLING DAYS) HAVE BEEN COLLECTED.
ND = NO DATA
IN = INSUFFICIENT DATA TO CALCULATE THE ANNUAL GEOMETRIC MEAN

TABLE 4-3

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 11/10/83 SULFUR DIOXIDE CONCENTRATION BY SMSA POPULATION RANGE PAGE NO: 1

STANDARD METROPOLITAN STATISTICAL AREA	SULFUR DIOXIDE CONCENTRATION (PPM) HIGHEST ANNUAL ARITHMETIC MEAN 1980	1981	1982
POPULATION: > 2 MILLION			
NEW YORK, NY-NJ	.029	.025	.025
LOS ANGELES-LONG BEACH, CA	.012	.011	.003
CHICAGO, IL	.016	.015	.012
PHILADELPHIA PA-NJ	.020	.022	.020
DETROIT, MI	.017	.017	.018
SAN FRANCISCO-OAKLAND, CA	.004	.005	.009
WASHINGTON, DC-MD-VA	.017	.017	.018
DALLAS-FORT WORTH, TX	.003	.003	.003
HOUSTON, TX	.009	.005	.009
BOSTON, MA	.021	.019	.018
NASSAU-SUFFOLK, NY	.011	.011	.012
ST. LOUIS, MO-IL	.023	.022	.020
PITTSBURGH, PA	.042	.045	.046

NOTE: FOR CONTINUOUS INSTRUMENTS, THE ANNUAL ARITHMETIC MEAN IS CALCULATED IF AT LEAST 4380 HOURLY VALUES ARE COLLECTED. FOR INSTRUMENTS WHICH COLLECT ONLY ONE MEASUREMENT PER 24-HR PERIOD (BUBBLERS), THE ANNUAL ARITHMETIC MEAN IS CALCULATED IF THE DATA SATISFIES THE NADB VALIDITY CRITERIA OR AT LEAST 30 DAYS OF 24-HR DATA (50% OF THE EPA RECOMMENDED SAMPLING DAYS) HAVE BEEN COLLECTED.

ND = NO DATA
IN = INSUFFICIENT DATA TO CALCULATE THE ANNUAL ARITHMETIC MEAN
B = REPRESENTS A 24-HR BUBBLER MEASUREMENT

TABLE 4-3

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 11/10/83 SULFUR DIOXIDE CONCENTRATION BY SMSA POPULATION RANGE PAGE NO: 2

STANDARD METROPOLITAN STATISTICAL AREA	SULFUR DIOXIDE CONCENTRATION (PPM) HIGHEST ANNUAL ARITHMETIC MEAN 1980	1981	1982
POPULATION: > 2 MILLION (CONT)			
BALTIMORE, MD	.013	.015	.020
MINNEAPOLIS-ST. PAUL, MN-WI	.019	.015	.018
ATLANTA, GA	.011	.009	IN

TOTAL SMSA'S > 2 MILLION : 16

NOTE: FOR CONTINUOUS INSTRUMENTS, THE ANNUAL ARITHMETIC MEAN IS CALCULATED IF AT LEAST 4380 HOURLY VALUES ARE COLLECTED. FOR INSTRUMENTS WHICH COLLECT ONLY ONE MEASUREMENT PER 24-HR PERIOD (BUBBLERS), THE ANNUAL ARITHMETIC MEAN IS CALCULATED IF THE DATA SATISFIES THE NADB VALIDITY CRITERIA OR AT LEAST 30 DAYS OF 24-HR DATA (50% OF THE EPA RECOMMENDED SAMPLING DAYS) HAVE BEEN COLLECTED.

ND = NO DATA

IN = INSUFFICIENT DATA TO CALCULATE THE ANNUAL ARITHMETIC MEAN

B = REPRESENTS A 24-HR BUBBLER MEASUREMENT

TABLE 4-3

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 11/10/83 SULFUR DIOXIDE CONCENTRATION BY SMSA POPULATION RANGE PAGE NO: 3

STANDARD METROPOLITAN STATISTICAL AREA	SULFUR DIOXIDE CONCENTRATION (PPM) HIGHEST ANNUAL ARITHMETIC MEAN 1980	1981	1982
POPULATION: 1 - 2 MILLION			
NEWARK, NJ	.018	.021	.017
ANAHEIM-SANTA ANA-GARDEN GROVE, CA	.010	.007	IN
CLEVELAND, OH	.018	.019	.023
SAN DIEGO, CA	.008	.007	.007
MIAMI, FL	.003	.003	.003
DENVER-BOULDER, CO	.013	.013	.010
SEATTLE-EVERETT, WA	.008	.015	.015
TAMPA-ST. PETERSBURG, FL	.008	.010	.009
RIVERSIDE-SAN BERNARDINO-ONTARIO, CA	.006	.007	.006
PHOENIX, AZ	.006	.006	IN
CINCINNATI, OH-KY-IN	.019 B	.014	.015
MILWAUKEE, WI	.012	.009	.010
KANSAS CITY, MO-KS	.017	.019	.014

NOTE: FOR CONTINUOUS INSTRUMENTS, THE ANNUAL ARITHMETIC MEAN IS CALCULATED IF AT LEAST 4380 HOURLY VALUES ARE COLLECTED. FOR INSTRUMENTS WHICH COLLECT ONLY ONE MEASUREMENT PER 24-HR PERIOD (BUBBLERS), THE ANNUAL ARITHMETIC MEAN IS CALCULATED IF THE DATA SATISFIES THE NADB VALIDITY CRITERIA OR AT LEAST 30 DAYS OF 24-HR DATA (50% OF THE EPA RECOMMENDED SAMPLING DAYS) HAVE BEEN COLLECTED.
ND = NO DATA
IN = INSUFFICIENT DATA TO CALCULATE THE ANNUAL ARITHMETIC MEAN
B = REPRESENTS A 24-HR BUBBLER MEASUREMENT

TABLE 4-3

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 11/10/83 SULFUR DIOXIDE CONCENTRATION BY SMSA POPULATION RANGE PAGE NO: 4

STANDARD METROPOLITAN STATISTICAL AREA	SULFUR DIOXIDE CONCENTRATION (PPM) HIGHEST ANNUAL ARITHMETIC MEAN 1980	1981	1982
POPULATION: 1 - 2 MILLION (CONT)			
SAN JOSE, CA	ND	ND	ND
BUFFALO, NY	.029	.026	.017
PORTLAND, OR-WA	.012	.012	.009
NEW ORLEANS, LA	ND	ND	.004
INDIANAPOLIS, IN	.017	.027	.019
COLUMBUS, OH	.009	.015	.017
SAN JUAN, PR	.007	IN	.008
SAN ANTONIO, TX	.002	.002	.003
FORT LAUDERDALE-HOLLYWOOD, FL	.003 B	.002 B	.001 B
SACRAMENTO, CA	.002	.004	.002

TOTAL SMSA'S 1 - 2 MILLION : 23

NOTE: FOR CONTINUOUS INSTRUMENTS, THE ANNUAL ARITHMETIC MEAN IS CALCULATED IF AT LEAST 4380 HOURLY VALUES ARE COLLECTED. FOR INSTRUMENTS WHICH COLLECT ONLY ONE MEASUREMENT PER 24-HR PERIOD (BUBBLERS), THE ANNUAL ARITHMETIC MEAN IS CALCULATED IF THE DATA SATISFIES THE NADB VALIDITY CRITERIA OR AT LEAST 30 DAYS OF 24-HR DATA (50% OF THE EPA RECOMMENDED SAMPLING DAYS) HAVE BEEN COLLECTED.

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TABLE 4-3

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 11/10/83 SULFUR DIOXIDE CONCENTRATION BY SMSA POPULATION RANGE PAGE NO: 5

STANDARD METROPOLITAN STATISTICAL AREA	SULFUR DIOXIDE CONCENTRATION (PPM) HIGHEST ANNUAL ARITHMETIC MEAN 1980	1981	1982
POPULATION: .5 - 1 MILLION			
ROCHESTER, NY	.026	.022	.014
SALT LAKE CITY-OGDEN, UT	.031	.035	.026
PROVIDENCE-WARWICK-PAWTUCKET, RI-MA	.016	.015	.016
MEMPHIS, TN-AR-MS	.019	.018	.011
LOUISVILLE, KY-IN	.026	.019	.017
NASHVILLE-DAVIDSON, TN	.012	.011	.013
BIRMINGHAM, AL	ND	.007	IN
OKLAHOMA CITY, OK	.001	.003	.001
DAYTON, OH	.009	.008 B	.008
GREENSBORO-WINSTON-SALEM-HIGH POINT, NC	.006 B	.004 B	.005 B
NORFOLK-VIRGINIA BEACH-PORTSMOUTH, VA-NC	.012	.013	.011
ALBANY-SCHENECTADY-TROY, NY	.013	.013	.018
TOLEDO, OH-MI	.013	.014	.012

NOTE: FOR CONTINUOUS INSTRUMENTS, THE ANNUAL ARITHMETIC MEAN IS CALCULATED IF AT LEAST 4380 HOURLY VALUES ARE COLLECTED. FOR INSTRUMENTS WHICH COLLECT ONLY ONE MEASUREMENT PER 24-HR PERIOD (BUBBLERS), THE ANNUAL ARITHMETIC MEAN IS CALCULATED IF THE DATA SATISFIES THE NADB VALIDITY CRITERIA OR AT LEAST 30 DAYS OF 24-HR DATA (50% OF THE EPA RECOMMENDED SAMPLING DAYS) HAVE BEEN COLLECTED.
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TABLE 4-3

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 11/10/83 SULFUR DIOXIDE CONCENTRATION BY SMSA POPULATION RANGE PAGE NO: 6

STANDARD METROPOLITAN STATISTICAL AREA	SULFUR DIOXIDE CONCENTRATION (PPM) HIGHEST ANNUAL ARITHMETIC MEAN 1980	1981	1982
POPULATION: .5 - 1 MILLION (CONT)			
HONOLULU, HI	.007 B	.007 B	.004 B
JACKSONVILLE, FL	.018 B	.020 B	.007
HARTFORD, CT	.015	.011	.014
ORLANDO, FL	.002 B	.006	.006
TULSA, OK	.008	.008	.008
AKRON, OH	.022	.021	.019
GARY-HAMMOND-EAST CHICAGO, IN	.022	.017	.018
SYRACUSE, NY	.011	.010	.010
NORTHEAST PENNSYLVANIA	.012	.012	.013
CHARLOTTE-GASTONIA, NC	.011	.011	.011
ALLENTOWN-BETHLEHEM-EASTON, PA-NJ	.015	.016	.014
RICHMOND, VA	IN	IN	.008
GRAND RAPIDS, MI	IN	.008	.008

NOTE: FOR CONTINUOUS INSTRUMENTS, THE ANNUAL ARITHMETIC MEAN IS CALCULATED IF AT LEAST 4380 HOURLY VALUES ARE COLLECTED. FOR INSTRUMENTS WHICH COLLECT ONLY ONE MEASUREMENT PER 24-HR PERIOD (BUBBLERS), THE ANNUAL ARITHMETIC MEAN IS CALCULATED IF THE DATA SATISFIES THE NADB VALIDITY CRITERIA OR AT LEAST 30 DAYS OF 24-HR DATA (50% OF THE EPA RECOMMENDED SAMPLING DAYS) HAVE BEEN COLLECTED.
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TABLE 4-3

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 11/10/83 SULFUR DIOXIDE CONCENTRATION BY SMSA POPULATION RANGE PAGE NO: 7

STANDARD METROPOLITAN STATISTICAL AREA	SULFUR DIOXIDE CONCENTRATION (PPM) HIGHEST ANNUAL ARITHMETIC MEAN 1980	1981	1982
POPULATION: .5 - 1 MILLION (CONT)			
NEW BRUNSWICK-PERTH AMBOY-SAYREVILLE, NJ	.015	.018	.014
WEST PALM BEACH-BOCA RATON, FL	.002 B	.003	.003
OMAHA, NE-IA	.010	.004 B	.004
GREENVILLE-SPARTANBURG, SC	IN	.003	.006
JERSEY CITY, NJ	.016	.018	.015
AUSTIN, TX	.001	.001	.006
YOUNGSTOWN-WARREN, OH	.017 B	.015 B	.016
TUCSON, AZ	.009	.016	.011
RALEIGH-DURHAM, NC	.003 B	.003 B	.002 B
SPRINGFIELD-CHICOPEE-HOLYOKE, MA-CT	.013	.011	.012
OXNARD-SIMI VALLEY-VENTURA, CA	.003	ND	.003
WILMINGTON, DE-NJ-MD	.012	.010	.010
FLINT, MI	.005	.014	.016

NOTE: FOR CONTINUOUS INSTRUMENTS, THE ANNUAL ARITHMETIC MEAN IS CALCULATED IF AT LEAST 4380 HOURLY VALUES ARE COLLECTED. FOR INSTRUMENTS WHICH COLLECT ONLY ONE MEASUREMENT PER 24-HR PERIOD (BUBBLERS), THE ANNUAL ARITHMETIC MEAN IS CALCULATED IF THE DATA SATISFIES THE NADB VALIDITY CRITERIA OR AT LEAST 30 DAYS OF 24-HR DATA (50% OF THE EPA RECOMMENDED SAMPLING DAYS) HAVE BEEN COLLECTED.

ND = NO DATA
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B = REPRESENTS A 24-HR BUBBLER MEASUREMENT

TABLE 4-3

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 11/10/83 SULFUR DIOXIDE CONCENTRATION BY SMSA POPULATION RANGE PAGE NO: 8

STANDARD METROPOLITAN STATISTICAL AREA	SULFUR DIOXIDE CONCENTRATION (PPM) HIGHEST ANNUAL ARITHMETIC MEAN 1980	1981	1982
POPULATION: .5 - 1 MILLION (CONT)			
FRESNO, CA	.003	.003	.004
LONG BRANCH-ASBURY PARK, NJ	.008	.008	.007
TOTAL SMSA'S .5 - 1 MILLION : 41			

NOTE: FOR CONTINUOUS INSTRUMENTS, THE ANNUAL ARITHMETIC MEAN IS CALCULATED IF AT LEAST 4380 HOURLY VALUES ARE COLLECTED. FOR INSTRUMENTS WHICH COLLECT ONLY ONE MEASUREMENT PER 24-HR PERIOD (BUBBLERS), THE ANNUAL ARITHMETIC MEAN IS CALCULATED IF THE DATA SATISFIES THE NADB VALIDITY CRITERIA OR AT LEAST 30 DAYS OF 24-HR DATA (50% OF THE EPA RECOMMENDED SAMPLING DAYS) HAVE BEEN COLLECTED.

ND = NO DATA
IN = INSUFFICIENT DATA TO CALCULATE THE ANNUAL ARITHMETIC MEAN
B = REPRESENTS A 24-HR BUBBLER MEASUREMENT

TABLE 4-4

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 12/05/83 SULFUR DIOXIDE CONCENTRATION BY SMSA POPULATION RANGE PAGE NO: 1

STANDARD METROPOLITAN STATISTICAL AREA	SULFUR DIOXIDE CONCENTRATION (PPM) HIGHEST 2ND MAX 24-HR AVG. 1980	1981	1982
POPULATION: > 2 MILLION			
NEW YORK, NY-NJ	.105	.097	.079
LOS ANGELES-LONG BEACH, CA	.036 *	.036	.027 *
CHICAGO, IL	.051	.061	.056
PHILADELPHIA PA-NJ	.080	.081	.065
DETROIT, MI	.068	.102	.069
SAN FRANCISCO-OAKLAND, CA	.031	.018	.020
WASHINGTON, DC-MD-VA	.051	.047	.060
DALLAS-FORT WORTH, TX	.020	.029	.017
HOUSTON, TX	.040	.047 *	.071
BOSTON, MA	.063	.066	.061
NASSAU-SUFFOLK, NY	.053	.054	.056
ST. LOUIS, MO-IL	.098	.114	.479 **
PITTSBURGH, PA	.134	.192	.212

NOTE: THE 24-HR AVERAGE IS CALCULATED BASED ON THE MIDNIGHT TO MIDNIGHT PERIOD.
* LESS THAN 183 DAYS OF DATA
ND = NO DATA
B = REPRESENTS A 24-HR BUBBLER MEASUREMENT

** = This value has been reviewed and verified by EPA's Regional Office. It results from SO_2 emissions from 2 power plants near the monitoring site.

TABLE 4-4

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 12/05/83 SULFUR DIOXIDE CONCENTRATION BY SMSA POPULATION RANGE PAGE NO: 2

STANDARD METROPOLITAN STATISTICAL AREA	SULFUR DIOXIDE CONCENTRATION (PPM) HIGHEST 2ND MAX 24-HR AVG. 1980	1981	1982
POPULATION: > 2 MILLION (CONT)			
BALTIMORE,MD	.043 *	.058 *	.071 *
MINNEAPOLIS-ST. PAUL, MN-WI	.172	.160	.225
ATLANTA, GA	.038	.034	.038 *

TOTAL SMSA'S > 2 MILLION : 16

NOTE: THE 24-HR AVERAGE IS CALCULATED BASED ON THE MIDNIGHT TO MIDNIGHT PERIOD.
* LESS THAN 183 DAYS OF DATA
ND = NO DATA
B = REPRESENTS A 24-HR BUBBLER MEASUREMENT

TABLE 4-4

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 12/05/83 SULFUR DIOXIDE CONCENTRATION BY SMSA POPULATION RANGE PAGE NO: 3

STANDARD METROPOLITAN STATISTICAL AREA	SULFUR DIOXIDE CONCENTRATION (PPM) HIGHEST 2ND MAX 24-HR AVG.		
	1980	1981	1982
POPULATION: 1 - 2 MILLION			
NEWARK, NJ	.056	.114	.067
ANAHEIM-SANTA ANA-GARDEN GROVE, CA	.031	.019	.015 *
CLEVELAND, OH	.125	.081 *	.071
SAN DIEGO, CA	.035	.023	.030
MIAMI, FL	.007	.010	.009
DENVER-BOULDER, CO	.057	.043	.039
SEATTLE-EVERETT, WA	.045	.066	.051
TAMPA-ST. PETERSBURG, FL	.048	.042	.047
RIVERSIDE-SAN BERNARDINO-ONTARIO, CA	.024	.030	.016
PHOENIX, AZ	.015 *	.037	.011 *
CINCINNATI, OH-KY-IN	.105	.106	.096
MILWAUKEE, WI	.093	.066	.049
KANSAS CITY, MO-KS	.137	.208	.128

NOTE: THE 24-HR AVERAGE IS CALCULATED BASED ON THE MIDNIGHT TO MIDNIGHT PERIOD.
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TABLE 4-4

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 12/05/83 SULFUR DIOXIDE CONCENTRATION BY SMSA POPULATION RANGE PAGE NO: 4

STANDARD METROPOLITAN STATISTICAL AREA	SULFUR DIOXIDE CONCENTRATION (PPM) HIGHEST 2ND MAX 24-HR AVG. 1980	1981	1982
POPULATION: 1 - 2 MILLION (CONT)			
SAN JOSE, CA	ND	ND	ND
BUFFALO, NY	.124	.277	.077 *
PORTLAND, OR-WA	.043	.051	.033
NEW ORLEANS, LA	ND	ND	ND
INDIANAPOLIS, IN	.069	.073 *	.068
COLUMBUS, OH	.040	.064	.066
SAN JUAN, PR	.037	.038 *	.040
SAN ANTONIO, TX	.008	.008	.011
FORT LAUDERDALE-HOLLYWOOD, FL	.011 *B	.009 *B	.004 *B
SACRAMENTO, CA	.015 *	.011	.008

TOTAL SMSA'S 1 - 2 MILLION : 23

NOTE: THE 24-HR AVERAGE IS CALCULATED BASED ON THE MIDNIGHT TO MIDNIGHT PERIOD.
* LESS THAN 183 DAYS OF DATA
ND = NO DATA
B = REPRESENTS A 24-HR BUBBLER MEASUREMENT

TABLE 4-4

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 12/05/83 SULFUR DIOXIDE CONCENTRATION BY SMSA POPULATION RANGE PAGE NO: 5

STANDARD METROPOLITAN STATISTICAL AREA	SULFUR DIOXIDE CONCENTRATION (PPM) HIGHEST 2ND MAX 24-HR AVG. 1980	1981	1982
POPULATION: .5 - 1 MILLION			
ROCHESTER, NY	.111	.090	.055
SALT LAKE CITY-OGDEN, UT	.139	.160	.085
PROVIDENCE-WARWICK-PAWTUCKET, RI-MA	.065	.071	.060
MEMPHIS, TN-AR-MS	.108	.157	.055
LOUISVILLE, KY-IN	.108	.130	.077
NASHVILLE-DAVIDSON, TN	.078	.072	.077
BIRMINGHAM, AL	ND	.024	.029 *
OKLAHOMA CITY, OK	.006 *	.009	.012 *
DAYTON, OH	.040	.035	.039
GREENSBORO-WINSTON-SALEM-HIGH POINT, NC	.039 *B	.015 *B	.016 *B
NORFOLK-VIRGINIA BEACH-PORTSMOUTH, VA-NC	.044	.047	.034
ALBANY-SCHENECTADY-TROY, NY	.065 *	.066 *	.068
TOLEDO, OH-MI	.086	.061	.082

NOTE: THE 24-HR AVERAGE IS CALCULATED BASED ON THE MIDNIGHT TO MIDNIGHT PERIOD.
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TABLE 4-4

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 12/05/83 SULFUR DIOXIDE CONCENTRATION BY SMSA POPULATION RANGE PAGE NO: 6

STANDARD METROPOLITAN STATISTICAL AREA	SULFUR DIOXIDE CONCENTRATION (PPM) HIGHEST 2ND MAX 24-HR AVG. 1980	1981	1982
POPULATION: .5 - 1 MILLION (CONT)			
HONOLULU, HI	.022 *B	.013 *B	.024
JACKSONVILLE, FL	.058	.122	.056 *
HARTFORD, CT	.065	.074	.053
ORLANDO, FL	.014 *	.025	.034
TULSA, OK	.043	.071	.053
AKRON, OH	.097	.117	.114
GARY-HAMMOND-EAST CHICAGO, IN	.114	.100	.094
SYRACUSE, NY	.053	.034	.038
NORTHEAST PENNSYLVANIA	.072	.066	.055
CHARLOTTE-GASTONIA, NC	.032	.042	.043
ALLENTOWN-BETHLEHEM-EASTON, PA-NJ	.054	.074	.052
RICHMOND, VA	.038 *	.049 *	.036
GRAND RAPIDS, MI	.018 *	.030	.025

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TABLE 4-4

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 12/05/83 SULFUR DIOXIDE CONCENTRATION BY SMSA POPULATION RANGE PAGE NO: 7

STANDARD METROPOLITAN STATISTICAL AREA	SULFUR DIOXIDE CONCENTRATION (PPM) HIGHEST 2ND MAX 24-HR AVG. 1980	1981	1982
POPULATION: .5 - 1 MILLION (CONT)			
NEW BRUNSWICK-PERTH AMBOY-SAYREVILLE, NJ	.087	.085	.058
WEST PALM BEACH-BOCA RATON, FL	.011 *	.018	.016
OMAHA, NE-IA	.035	ND	.033
GREENVILLE-SPARTANBURG, SC	.006 *	.016	.026 *
JERSEY CITY, NJ	.054	.078	.050
AUSTIN, TX	.007	.006	.012
YOUNGSTOWN-WARREN, OH	.060	.058	.062
TUCSON, AZ	.170	.106	.054
RALEIGH-DURHAM, NC	.014 *	.009 *B	.004 *B
SPRINGFIELD-CHICOPEE-HOLYOKE, MA-CT	.050	.055	.066
OXNARD-SIMI VALLEY-VENTURA, CA	.014	ND	.011
WILMINGTON, DE-NJ-MD	.050	.058	.042
FLINT, MI	.024	.036	.045

NOTE: THE 24-HR AVERAGE IS CALCULATED BASED ON THE MIDNIGHT TO MIDNIGHT PERIOD.
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ND = NO DATA
B = REPRESENTS A 24-HR BUBBLER MEASUREMENT

TABLE 4-4

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 12/05/83 SULFUR DIOXIDE CONCENTRATION BY SMSA POPULATION RANGE PAGE NO: 8

STANDARD METROPOLITAN STATISTICAL AREA	SULFUR DIOXIDE CONCENTRATION (PPM) HIGHEST 2ND MAX 24-HR AVG. 1980	1981	1982
POPULATION: .5 - 1 MILLION (CONT)			
FRESNO, CA	.038	.012	.016
LONG BRANCH-ASBURY PARK, NJ	.041	.050	.041
TOTAL SMSA'S .5 - 1 MILLION : 41			

NOTE: THE 24-HR AVERAGE IS CALCULATED BASED ON THE MIDNIGHT TO MIDNIGHT PERIOD.
* LESS THAN 183 DAYS OF DATA
ND = NO DATA
B = REPRESENTS A 24-HR BUBBLER MEASUREMENT

TABLE 4-5

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 11/16/83 CARBON MONOXIDE CONCENTRATION BY SMSA POPULATION RANGE PAGE NO: 1

STANDARD METROPOLITAN STATISTICAL AREA	CARBON MONOXIDE CONCENTRATION (PPM) HIGHEST 2ND MAX 8-HR N/O AVG. 1980	1981	1982
POPULATION: > 2 MILLION			
NEW YORK, NY-NJ	15	15	13
LOS ANGELES-LONG BEACH, CA	25	21	19 *
CHICAGO, IL	14	10	14
PHILADELPHIA, PA-NJ	9	10	12
DETROIT, MI	8	12	10
SAN FRANCISCO-OAKLAND, CA	7 *	7	9
WASHINGTON, DC-MD-VA	13 *	13	12
DALLAS-FORT WORTH, TX	5	7	7
HOUSTON, TX	8	7	10
BOSTON, MA	11 *	10	21
NASSAU-SUFFOLK, NY	10	11	10
ST. LOUIS, MO-IL	14	11	9 *
PITTSBURGH, PA	11	11	11

NOTE: N/O NON-OVERLAPPING
* LESS THAN 4380 HOURLY VALUES OF DATA
ND = NO DATA

TABLE 4-5

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 11/16/83 CARBON MONOXIDE CONCENTRATION BY SMSA POPULATION RANGE PAGE NO: 2

STANDARD METROPOLITAN STATISTICAL AREA	CARBON MONOXIDE CONCENTRATION (PPM) HIGHEST 2ND MAX 8-HR N/O AVG. 1980	1981	1982
POPULATION: > 2 MILLION (CONT)			
BALTIMORE,MD	11 *	13	12
MINNEAPOLIS-ST. PAUL, MN-WI	12	13 *	14
ATLANTA, GA	16	10	8
TOTAL SMSA'S > 2 MILLION : 16			

NOTE: N/O NON-OVERLAPPING
* LESS THAN 4380 HOURLY VALUES OF DATA
ND = NO DATA

TABLE 4-5

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 11/16/83 CARBON MONOXIDE CONCENTRATION BY SMSA POPULATION RANGE PAGE NO: 3

STANDARD METROPOLITAN STATISTICAL AREA	CARBON MONOXIDE CONCENTRATION (PPM) HIGHEST 2ND MAX 8-HR N/O AVG.		
	1980	1981	1982
POPULATION: 1 - 2 MILLION			
NEWARK, NJ	15	13	13
ANAHEIM-SANTA ANA-GARDEN GROVE, CA	18	12	11 *
CLEVELAND, OH	11	10	9
SAN DIEGO, CA	9	9	9
MIAMI, FL	15 *	15	11
DENVER-BOULDER, CO	21	28	15
SEATTLE-EVERETT, WA	12	14	12
TAMPA-ST. PETERSBURG, FL	10	8	7
RIVERSIDE-SAN BERNARDINO-ONTARIO, CA	8	9	7
PHOENIX, AZ	19 *	19	18
CINCINNATI, OH-KY-IN	6	10	8
MILWAUKEE, WI	8	9	9
KANSAS CITY, MO-KS	9	15	12

NOTE: N/O NON-OVERLAPPING
* LESS THAN 4380 HOURLY VALUES OF DATA
ND = NO DATA

TABLE 4-5

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 11/16/83 CARBON MONOXIDE CONCENTRATION BY SMSA POPULATION RANGE PAGE NO: 4

STANDARD METROPOLITAN STATISTICAL AREA	CARBON MONOXIDE CONCENTRATION (PPM) HIGHEST 2ND MAX 8-HR N/O AVG. 1980	1981	1982
POPULATION: 1 - 2 MILLION (CONT)			
SAN JOSE, CA	16	11	11
BUFFALO, NY	5	6	5
PORTLAND, OR-WA	13	12	10
NEW ORLEANS, LA	ND	7	10
INDIANAPOLIS, IN	11	15	11
COLUMBUS, OH	12	10	9
SAN JUAN, PR	ND	13 *	18
SAN ANTONIO, TX	8	8 *	9
FORT LAUDERDALE-HOLLYWOOD, FL	10	10	9
SACRAMENTO, CA	13 *	12	10

TOTAL SMSA'S 1 - 2 MILLION : 23

NOTE: N/O NON-OVERLAPPING
* LESS THAN 4380 HOURLY VALUES OF DATA
ND = NO DATA

TABLE 4-5

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 11/16/83 CARBON MONOXIDE CONCENTRATION BY SMSA POPULATION RANGE PAGE NO: 5

STANDARD METROPOLITAN STATISTICAL AREA	CARBON MONOXIDE CONCENTRATION (PPM) HIGHEST 2ND MAX 8-HR N/O AVG. 1980	1981	1982
POPULATION: .5 - 1 MILLION			
ROCHESTER, NY	5	9	6
SALT LAKE CITY-OGDEN, UT	15	11 *	12
PROVIDENCE-WARWICK-PAWTUCKET, RI-MA	12	10	9
MEMPHIS, TN-AR-MS	11	14	13 *
LOUISVILLE, KY-IN	13	13	13
NASHVILLE-DAVIDSON, TN	11 *	12	12
BIRMINGHAM, AL	9 *	8 *	9
OKLAHOMA CITY, OK	5 *	8	8
DAYTON, OH	7	8	7
GREENSBORO-WINSTON-SALEM-HIGH POINT, NC	6	7	8
NORFOLK-VIRGINIA BEACH-PORTSMOUTH, VA-NC	7	6	6
ALBANY-SCHENECTADY-TROY, NY	6	7	8
TOLEDO, OH-MI	6	7	7

NOTE: N/O NON-OVERLAPPING
* LESS THAN 4380 HOURLY VALUES OF DATA
ND = NO DATA

TABLE 4-5

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 11/16/83 CARBON MONOXIDE CONCENTRATION BY SMSA POPULATION RANGE PAGE NO: 6

STANDARD METROPOLITAN STATISTICAL AREA	CARBON MONOXIDE CONCENTRATION (PPM) HIGHEST 2ND MAX 8-HR N/O AVG. 1980	1981	1982
POPULATION: .5 - 1 MILLION (CONT)			
HONOLULU, HI	1	6	7
JACKSONVILLE, FL	9	9	9
HARTFORD, CT	9	8	9
ORLANDO, FL	9 *	8 *	9
TULSA, OK	10 *	10 *	6
AKRON, OH	8	11 *	6
GARY-HAMMOND-EAST CHICAGO, IN	4 *	10	6 *
SYRACUSE, NY	5	4	5
NORTHEAST PENNSYLVANIA	5 *	ND	6 *
CHARLOTTE-GASTONIA, NC	17	12	11
ALLENTOWN-BETHLEHEM-EASTON, PA-NJ	6	5 *	8 *
RICHMOND, VA	12	9	8
GRAND RAPIDS, MI	3 *	6	5

NOTE: N/O NON-OVERLAPPING
* LESS THAN 4380 HOURLY VALUES OF DATA
ND = NO DATA

TABLE 4-5

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 11/16/83 CARBON MONOXIDE CONCENTRATION BY SMSA POPULATION RANGE PAGE NO: 7

STANDARD METROPOLITAN STATISTICAL AREA	CARBON MONOXIDE CONCENTRATION (PPM) HIGHEST 2ND MAX 8-HR N/O AVG. 1980	1981	1982
POPULATION: .5 - 1 MILLION (CONT)			
NEW BRUNSWICK-PERTH AMBOY-SAYREVILLE, NJ	9	7	8
WEST PALM BEACH-BOCA RATON, FL	5	5	7
OMAHA, NE-IA	6	9	16 *
GREENVILLE-SPARTANBURG, SC	9 *	ND	ND
JERSEY CITY, NJ	11	10	13
AUSTIN, TX	3 *	ND	ND
YOUNGSTOWN-WARREN, OH	6	7	5
TUCSON, AZ	11	10	11
RALEIGH-DURHAM, NC	14	12	14 *
SPRINGFIELD-CHICOPEE-HOLYOKE, MA-CT	9	7 *	9
OXNARD-SIMI VALLEY-VENTURA, CA	6	ND	7
WILMINGTON, DE-NJ-MD	7	11	7
FLINT, MI	ND	1 *	ND

NOTE: N/O NON-OVERLAPPING
* LESS THAN 4380 HOURLY VALUES OF DATA
ND = NO DATA

TABLE 4-5

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 11/16/83   CARBON MONOXIDE   CONCENTRATION BY SMSA POPULATION RANGE   PAGE NO: 8

STANDARD METROPOLITAN STATISTICAL AREA	CARBON MONOXIDE CONCENTRATION (PPM) HIGHEST 2ND MAX 8-HR N/O AVG. 1980	1981	1982
POPULATION: .5 - 1 MILLION (CONT)			
FRESNO, CA	15	12	13
LONG BRANCH-ASBURY PARK, NJ	9	10	8
TOTAL SMSA'S .5 - 1 MILLION : 41			

NOTE: N/O NON-OVERLAPPING
* LESS THAN 4380 HOURLY VALUES OF DATA
ND = NO DATA

TABLE 4-6

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 11/09/83 NITROGEN DIOXIDE CONCENTRATION BY SMSA POPULATION RANGE PAGE NO: 1

STANDARD METROPOLITAN STATISTICAL AREA	NITROGEN DIOXIDE CONCENTRATION (PPM) HIGHEST ANNUAL ARITHMETIC MEAN 1980	1981	1982
POPULATION: > 2 MILLION			
NEW YORK, NY-NJ	.031	.034	.036
LOS ANGELES-LONG BEACH, CA	.071	.071	.062
CHICAGO, IL	.060 B	.052 B	.052 B
PHILADELPHIA, PA-NJ	.046	.046	.039
DETROIT, MI	.036	.038	.019
SAN FRANCISCO-OAKLAND, CA	.029	.027	.027
WASHINGTON, DC-MD-VA	.025 B	.034	.036
DALLAS-FORT WORTH, TX	.051 B	.017	.019
HOUSTON, TX	.043 B	.025	.024
BOSTON, MA	.050	.041	.036
NASSAU-SUFFOLK, NY	.030	.028	.033
ST. LOUIS, MO-IL	.035	.026	.025
PITTSBURGH, PA	.027	.034	.031

NOTE: FOR CONTINUOUS INSTRUMENTS, THE ANNUAL ARITHMETIC MEAN IS CALCULATED IF AT LEAST 4380 HOURLY VALUES ARE COLLECTED. FOR INSTRUMENTS WHICH COLLECT ONLY ONE MEASUREMENT PER 24-HR PERIOD (BUBBLERS), THE ANNUAL ARITHMETIC MEAN IS CALCULATED IF THE DATA SATISFIES THE NADB VALIDITY CRITERIA OR AT LEAST 30 DAYS OF 24-HR DATA (50% OF THE EPA RECOMMENDED SAMPLING DAYS) HAVE BEEN COLLECTED.
ND = NO DATA
IN = INSUFFICIENT DATA TO CALCULATE THE ANNUAL ARITHMETIC MEAN
B = REPRESENTS A 24-HR BUBBLER MEASUREMENT

TABLE 4-6

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 11/09/83 NITROGEN DIOXIDE CONCENTRATION BY SMSA POPULATION RANGE PAGE NO: 2

STANDARD METROPOLITAN STATISTICAL AREA	NITROGEN DIOXIDE CONCENTRATION (PPM) HIGHEST ANNUAL ARITHMETIC MEAN 1980	1981	1982
POPULATION: > 2 MILLION (CONT)			
BALTIMORE,MD	.039	.030	.032
MINNEAPOLIS-ST. PAUL, MN-WI	.036 B	.028 B	.023
ATLANTA, GA	.031 B	IN	.016
TOTAL SMSA'S > 2 MILLION : 16			

NOTE: FOR CONTINUOUS INSTRUMENTS, THE ANNUAL ARITHMETIC MEAN IS CALCULATED IF AT LEAST 4380 HOURLY VALUES ARE COLLECTED. FOR INSTRUMENTS WHICH COLLECT ONLY ONE MEASUREMENT PER 24-HR PERIOD (BUBBLERS), THE ANNUAL ARITHMETIC MEAN IS CALCULATED IF THE DATA SATISFIES THE NADB VALIDITY CRITERIA OR AT LEAST 30 DAYS OF 24-HR DATA (50% OF THE EPA RECOMMENDED SAMPLING DAYS) HAVE BEEN COLLECTED.

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TABLE 4-6

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 11/09/83 NITROGEN DIOXIDE CONCENTRATION BY SMSA POPULATION RANGE PAGE NO: 3

STANDARD METROPOLITAN STATISTICAL AREA	NITROGEN DIOXIDE CONCENTRATION (PPM) HIGHEST ANNUAL ARITHMETIC MEAN 1980	1981	1982
POPULATION: 1 - 2 MILLION			
NEWARK, NJ	.040	.034	.045
ANAHEIM-SANTA ANA-GARDEN GROVE, CA	.055	.061	.048
CLEVELAND, OH	.048 B	.039 B	.037 B
SAN DIEGO, CA	.036	.043	.030
MIAMI, FL	.006 B	.018	.023
DENVER-BOULDER, CO	.050	.047	.039
SEATTLE-EVERETT, WA	.020	.022	.048
TAMPA-ST. PETERSBURG, FL	.033 B	.030 B	.022 B
RIVERSIDE-SAN BERNARDINO-ONTARIO, CA	.050	.049	.044
PHOENIX, AZ	.009	.011	.031
CINCINNATI, OH-KY-IN	.050 B	.031	.034
MILWAUKEE, WI	IN	.026	.028
KANSAS CITY, MO-KS	ND	.014	.018

NOTE: FOR CONTINUOUS INSTRUMENTS, THE ANNUAL ARITHMETIC MEAN IS CALCULATED IF AT LEAST 4380 HOURLY VALUES ARE COLLECTED. FOR INSTRUMENTS WHICH COLLECT ONLY ONE MEASUREMENT PER 24-HR PERIOD (BUBBLERS), THE ANNUAL ARITHMETIC MEAN IS CALCULATED IF THE DATA SATISFIES THE NADB VALIDITY CRITERIA OR AT LEAST 30 DAYS OF 24-HR DATA (50% OF THE EPA RECOMMENDED SAMPLING DAYS) HAVE BEEN COLLECTED.
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TABLE 4-6

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
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REPORT DATE 11/09/83 NITROGEN DIOXIDE CONCENTRATION BY SMSA POPULATION RANGE PAGE NO: 4

STANDARD METROPOLITAN STATISTICAL AREA	NITROGEN DIOXIDE CONCENTRATION (PPM) HIGHEST ANNUAL ARITHMETIC MEAN 1980	1981	1982
POPULATION: 1 - 2 MILLION (CONT)			
SAN JOSE, CA	.036	.033	.032
BUFFALO, NY	.023	.026	.026
PORTLAND, OR-WA	.028	IN	ND
NEW ORLEANS, LA	.029 B	.030 B	.033 B
INDIANAPOLIS, IN	.036	.030	028
COLUM[illegible], OH	.032 B	.023	.020
SAN JUAN, PR	ND	ND	ND
SAN ANTONIO, TX	.030 B	.026 B	.013
FORT LAUDERDALE-HOLLYWOOD, FL	.027 B	.027 B	.022 B
SACRAMENTO, CA	.028	.021	.019

TOTAL SMSA'S 1 - 2 MILLION : 23

NOTE: FOR CONTINUOUS INSTRUMENTS, THE ANNUAL ARITHMETIC MEAN IS CALCULATED IF AT LEAST 4380 HOURLY VALUES ARE COLLECTED. FOR INSTRUMENTS WHICH COLLECT ONLY ONE MEASUREMENT PER 24-HR PERIOD (BUBBLERS), THE ANNUAL ARITHMETIC MEAN IS CALCULATED IF THE DATA SATISFIES THE NADB VALIDITY CRITERIA OR AT LEAST 30 DAYS OF 24-HR DATA (50% OF THE EPA RECOMMENDED SAMPLING DAYS) HAVE BEEN COLLECTED.

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TABLE 4-6

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 11/09/83 NITROGEN DIOXIDE CONCENTRATION BY SMSA POPULATION RANGE PAGE NO: 5

STANDARD METROPOLITAN STATISTICAL AREA	NITROGEN DIOXIDE CONCENTRATION (PPM) HIGHEST ANNUAL ARITHMETIC MEAN 1980	1981	1982
POPULATION: .5 - 1 MILLION			
ROCHESTER, NY	ND	ND	ND
SALT LAKE CITY-OGDEN, UT	.033	.028	.031
PROVIDENCE-WARWICK-PAWTUCKET, RI-MA	.036	IN	.025
MEMPHIS, TN-AR-MS	.034 B	IN	ND
LOUISVILLE, KY-IN	.041 B	.035	.034 B
NASHVILLE-DAVIDSON, TN	.047 B	.049 B	.053 B
BIRMINGHAM, AL	ND	ND	ND
OKLAHOMA CITY, OK	.019	.023	.018
DAYTON, OH	.029 B	.028 B	.027
GREENSBORO-WINSTON-SALEM-HIGH POINT, NC	.025 B	.022 B	.023 B
NORFOLK-VIRGINIA BEACH-PORTSMOUTH, VA-NC	.018	.015	.015
ALBANY-SCHENECTADY-TROY, NY	ND	ND	ND
TOLEDO, OH-MI	.032 B	.031 B	ND

NOTE: FOR CONTINUOUS INSTRUMENTS, THE ANNUAL ARITHMETIC MEAN IS CALCULATED IF AT LEAST 4380 HOURLY VALUES ARE COLLECTED. FOR INSTRUMENTS WHICH COLLECT ONLY ONE MEASUREMENT PER 24-HR PERIOD (BUBBLERS), THE ANNUAL ARITHMETIC MEAN IS CALCULATED IF THE DATA SATISFIES THE NADB VALIDITY CRITERIA OR AT LEAST 30 DAYS OF 24-HR DATA (50% OF THE EPA RECOMMENDED SAMPLING DAYS) HAVE BEEN COLLECTED.

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REPORT DATE 11/09/83 NITROGEN DIOXIDE CONCENTRATION BY SMSA POPULATION RANGE PAGE NO: 6

STANDARD METROPOLITAN STATISTICAL AREA	NITROGEN DIOXIDE CONCENTRATION (PPM) HIGHEST ANNUAL ARITHMETIC MEAN 1980	1981	1982
POPULATION: .5 - 1 MILLION (CONT)			
HONOLULU, HI	ND	IN	IN
JACKSONVILLE, FL	IN	.017	.008
HARTFORD, CT	.042 B	.019	.021
ORLANDO, FL	.022 B	.027	IN
TULSA, OK	.021	.010	.022
AKRON, OH	.029 B	.024 B	ND
GARY-HAMMOND-EAST CHICAGO, IN	IN	ND	.009
SYRACUSE, NY	.021	ND	ND
NORTHEAST PENNSYLVANIA	.032	.029	.022
CHARLOTTE-GASTONIA, NC	.031 B	.026 B	.026 B
ALLENTOWN-BETHLEHEM-EASTON, PA-NJ	.025	.026	.023
RICHMOND, VA	.031	IN	.024
GRAND RAPIDS, MI	IN	ND	ND

NOTE: FOR CONTINUOUS INSTRUMENTS, THE ANNUAL ARITHMETIC MEAN IS CALCULATED IF AT LEAST 4380 HOURLY VALUES ARE COLLECTED. FOR INSTRUMENTS WHICH COLLECT ONLY ONE MEASUREMENT PER 24-HR PERIOD (BUBBLERS), THE ANNUAL ARITHMETIC MEAN IS CALCULATED IF THE DATA SATISFIES THE NADB VALIDITY CRITERIA OR AT LEAST 30 DAYS OF 24-HR DATA (50% OF THE EPA RECOMMENDED SAMPLING DAYS) HAVE BEEN COLLECTED.

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
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REPORT DATE 11/09/83 NITROGEN DIOXIDE CONCENTRATION BY SMSA POPULATION RANGE PAGE NO: 7

STANDARD METROPOLITAN STATISTICAL AREA	NITROGEN DIOXIDE CONCENTRATION (PPM) HIGHEST ANNUAL ARITHMETIC MEAN 1980	1981	1982
POPULATION: .5 - 1 MILLION (CONT)			
NEW BRUNSWICK-PERTH AMBOY-SAYREVILLE, NJ	.025	IN	.027
WEST PALM BEACH-BOCA RATON, FL	.014	.015 B	IN
OMAHA, NE-IA	.027 B	.020 B	ND
GREENVILLE-SPARTANBURG, SC	IN	.029 B	.024 B
JERSEY CITY, NJ	.030	.028	.032
AUSTIN, TX	.021 B	ND	ND
YOUNGSTOWN-WARREN, OH	.041	.035	.029
TUCSON, AZ	.037	.037	.036
RALEIGH-DURHAM, NC	.022 B	.019 B	.018 B
SPRINGFIELD-CHICOPEE-HOLYOKE, MA-CT	ND	IN	.021
OXNARD-SIMI VALLEY-VENTURA, CA	.026	IN	.028
WILMINGTON, DE-NJ-MD	.034	IN	.020
FLINT, MI	ND	ND	ND

NOTE: FOR CONTINUOUS INSTRUMENTS, THE ANNUAL ARITHMETIC MEAN IS CALCULATED IF AT LEAST 4380 HOURLY VALUES ARE COLLECTED. FOR INSTRUMENTS WHICH COLLECT ONLY ONE MEASUREMENT PER 24-HR PERIOD (BUBBLERS), THE ANNUAL ARITHMETIC MEAN IS CALCULATED IF THE DATA SATISFIES THE NADB VALIDITY CRITERIA OR AT LEAST 30 DAYS OF 24-HR DATA (50% OF THE EPA RECOMMENDED SAMPLING DAYS) HAVE BEEN COLLECTED.

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TABLE 4-6

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 11/09/83 NITROGEN DIOXIDE CONCENTRATION BY SMSA POPULATION RANGE PAGE NO: 8

STANDARD METROPOLITAN STATISTICAL AREA	NITROGEN DIOXIDE CONCENTRATION (PPM) HIGHEST ANNUAL ARITHMETIC MEAN 1980	1981	1982
POPULATION: .5 - 1 MILLION (CONT)			
FRESNO, CA	.034	.026	.022
LONG BRANCH-ASBURY PARK, NJ	ND	ND	ND
TOTAL SMSA'S .5 - 1 MILLION : 41			

NOTE: FOR CONTINUOUS INSTRUMENTS, THE ANNUAL ARITHMETIC MEAN IS CALCULATED IF AT LEAST 4380 HOURLY VALUES ARE COLLECTED. FOR INSTRUMENTS WHICH COLLECT ONLY ONE MEASUREMENT PER 24-HR PERIOD (BUBBLERS), THE ANNUAL ARITHMETIC MEAN IS CALCULATED IF THE DATA SATISFIES THE NADB VALIDITY CRITERIA OR AT LEAST 30 DAYS OF 24-HR DATA (50% OF THE EPA RECOMMENDED SAMPLING DAYS) HAVE BEEN COLLECTED.

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IN = INSUFFICIENT DATA TO CALCULATE THE ANNUAL ARITHMETIC MEAN
B = REPRESENTS A 24-HR BUBBLER MEASUREMENT

TABLE 4-7

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 11/21/83 OZONE CONCENTRATION BY SMSA POPULATION RANGE PAGE NO: 1

STANDARD METROPOLITAN STATISTICAL AREA	OZONE HIGHEST 1980	1-HR CONCENTRATION (PPM) 2ND HIGH DAILY MAX 1981	1982
POPULATION: > 2 MILLION			
NEW YORK, NY-NJ	.18	.18	.17
LOS ANGELES-LONG BEACH, CA	.44 *	.35	.32
CHICAGO, IL	.15	.14	.12
PHILADELPHIA, PA-NJ	.24 *	.17	.18
DETROIT, MI	.15 *	.15	.16
SAN FRANCISCO-OAKLAND, CA	.18	.14	.14
WASHINGTON, DC-MD-VA	.19	.15	.15
DALLAS-FORT WORTH, TX	.18	.15	.17
HOUSTON, TX	.30	.23	.21
BOSTON, MA	.15	.13	.16 *
NASSAU-SUFFOLK, NY	.18	.14	.13
ST. LOUIS, MO-IL	.18	.15	.16
PITTSBURGH, PA	.17 *	.16	.14

* LESS THAN 50% OF DAYS IN OZONE SEASON
ND = NO DATA

TABLE 4-7

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 11/21/83 OZONE CONCENTRATION BY SMSA POPULATION RANGE PAGE NO: 2

STANDARD METROPOLITAN STATISTICAL AREA	OZONE CONCENTRATION (PPM) HIGHEST 1-HR 2ND HIGH DAILY MAX 1980		1981	1982
POPULATION: > 2 MILLION (CONT)				
BALTIMORE,MD	.18	*	.17	.14
MINNEAPOLIS-ST. PAUL, MN-WI	.14		.10	.10
ATLANTA, GA	.15		.14	.14
TOTAL SMSA'S > 2 MILLION : 16				

* LESS THAN 50% OF DAYS IN OZONE SEASON
ND = NO DATA

TABLE 4-7

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 11/21/83 OZONE CONCENTRATION BY SMSA POPULATION RANGE PAGE NO: 3

STANDARD METROPOLITAN STATISTICAL AREA	OZONE CONCENTRATION (PPM) HIGHEST 1-HR 2ND HIGH DAILY MAX 1980	1981	1982
POPULATION: 1 - 2 MILLION			
NEWARK, NJ	.16	.14	.17
ANAHEIM-SANTA ANA-GARDEN GROVE, CA	.29	.31	.18 *
CLEVELAND, OH	.12	.12	.13
SAN DIEGO, CA	.22	.24	.21
MIAMI, FL	.15	.14	.14
DENVER-BOULDER, CO	.13	.13	.14
SEATTLE-EVERETT, WA	.09	.12	.09
TAMPA-ST. PETERSBURG, FL	.13	.12	.12
RIVERSIDE-SAN BERNARDINO-ONTARIO, CA	.38	.34	.32
PHOENIX, AZ	.15	.16	.12
CINCINNATI, OH-KY-IN	.16	.13	.13
MILWAUKEE, WI	.14	.17	.13
KANSAS CITY, MO-KS	.16	.12	.10

* LESS THAN 50% OF DAYS IN OZONE SEASON
ND = NO DATA

TABLE 4-7

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 11/21/83 OZONE CONCENTRATION BY SMSA POPULATION RANGE PAGE NO: 4

STANDARD METROPOLITAN STATISTICAL AREA	OZONE HIGHEST 1980	1-HR CONCENTRATION (PPM) 2ND HIGH DAILY MAX 1981	1982
POPULATION: 1 - 2 MILLION (CONT)			
SAN JOSE, CA	.19 *	.14	.14
BUFFALO, NY	.14	.12 *	.11
PORTLAND, OR-WA	.10	.15	.12
NEW ORLEANS, LA	.12 *	.12	.17
INDIANAPOLIS, IN	.14	.13	.12
COLUMBUS, OH	.13	.11	.13
SAN JUAN, PR	ND	.07	.07 *
SAN ANTONIO, TX	.12	.12	.14
FORT LAUDERDALE-HOLLYWOOD, FL	.12 *	.11	.09
SACRAMENTO, CA	.17	.17	.16

TOTAL SMSA'S 1 - 2 MILLION : 23

* LESS THAN 50% OF DAYS IN OZONE SEASON
ND = NO DATA

TABLE 4-7

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 11/21/83 OZONE CONCENTRATION BY SMSA POPULATION RANGE PAGE NO: 5

STANDARD METROPOLITAN STATISTICAL AREA	OZONE HIGHEST 1-HR CONCENTRATION (PPM) 2ND HIGH DAILY MAX 1980	1981	1982
POPULATION: .5 - 1 MILLION			
ROCHESTER, NY	.12	.12	.11
SALT LAKE CITY-OGDEN, UT	.17	.16	.14
PROVIDENCE-WARWICK-PAWTUCKET, RI-MA	.21	.15	.15
MEMPHIS, TN-AR-MS	.13	.14	.13
LOUISVILLE, KY-IN	.19	.14	.17
NASHVILLE-DAVIDSON, TN	.13	.13	.11
BIRMINGHAM, AL	.16	.16	.15
OKLAHOMA CITY, OK	.12	.11	.11 *
DAYTON, OH	.13	.13	.16
GREENSBORO-WINSTON-SALEM-HIGH POINT, NC	.12	.11	.11
NORFOLK-VIRGINIA BEACH-PORTSMOUTH, VA-NC	.12	.12	.11
ALBANY-SCHENECTADY-TROY, NY	.13	.13	.12
TOLEDO, OH-MI	.14	.13	.13

* LESS THAN 50% OF DAYS IN OZONE SEASON
ND = NO DATA

TABLE 4-7

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
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RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 11/21/83 OZONE CONCENTRATION BY SMSA POPULATION RANGE PAGE NO: 6

STANDARD METROPOLITAN STATISTICAL AREA	OZONE CONCENTRATION (PPM) HIGHEST 1-HR 2ND HIGH DAILY MAX 1980	1981	1982
POPULATION: .5 - 1 MILLION (CONT)			
HONOLULU, HI	.04	.05	.07
JACKSONVILLE, FL	.12	.11	.12
HARTFORD, CT	.24	.15	.17
ORLANDO, FL	.10 *	.10	.10 *
TULSA, OK	.15	.15	.13
AKRON, OH	.12	.24	.14
GARY-HAMMOND-EAST CHICAGO, IN	.15 *	.14	.13
SYRACUSE, NY	.11	.11	.12
NORTHEAST PENNSYLVANIA	.15	.10	.16
CHARLOTTE-GASTONIA, NC	.14	.12	.12
ALLENTOWN-BETHLEHEM-EASTON, PA-NJ	.16	.12	.15
RICHMOND, VA	.13	.12	.12
GRAND RAPIDS, MI	.11 *	.11	.11

* LESS THAN 50% OF DAYS IN OZONE SEASON
ND = NO DATA

TABLE 4-7

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 11/21/83 OZONE CONCENTRATION BY SMSA POPULATION RANGE PAGE NO: 7

STANDARD METROPOLITAN STATISTICAL AREA	OZONE HIGHEST 1980	1-HR CONCENTRATION (PPM) 2ND HIGH DAILY MAX 1981	1982
POPULATION: .5 - 1 MILLION (CONT)			
NEW BRUNSWICK-PERTH AMBOY-SAYREVILLE, NJ	.19	.13	.16
WEST PALM BEACH-BOCA RATON, FL	.09	.09	.09
OMAHA, NE-IA	.15	.08	.09
GREENVILLE-SPARTANBURG, SC	.11	.11	.11
JERSEY CITY, NJ	.16	.14	.14
AUSTIN, TX	.13	.12	.11
YOUNGSTOWN-WARREN, OH	.12	.13	.11
TUCSON, AZ	.10	.12	.12
RALEIGH-DURHAM, NC	.13	.12	.09
SPRINGFIELD-CHICOPEE-HOLYOKE, MA-CT	.16	.16	.16
OXNARD-SIMI VALLEY-VENTURA, CA	.18	.20	.22
WILMINGTON, DE-NJ-MD	.17 *	.12 *	.16
FLINT, MI	.11	.11	.11

* LESS THAN 50% OF DAYS IN OZONE SEASON
ND = NO DATA

TABLE 4-7

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 11/21/83 OZONE CONCENTRATION BY SMSA POPULATION RANGE PAGE NO: 8

STANDARD METROPOLITAN STATISTICAL AREA	OZONE CONCENTRATION (PPM) HIGHEST 1-HR 2ND HIGH DAILY MAX 1980		1981	1982
POPULATION: .5 - 1 MILLION (CONT)				
FRESNO, CA	.19		.17	.16
LONG BRANCH-ASBURY PARK, NJ	.16	*	ND	ND
TOTAL SMSA'S .5 - 1 MILLION : 41				

* LESS THAN 50% OF DAYS IN OZONE SEASON
ND = NO DATA

TABLE 4-8

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 11/10/83 LEAD CONCENTRATION BY SMSA POPULATION RANGE PAGE NO: 1

STANDARD METROPOLITAN STATISTICAL AREA	LEAD HIGHEST 1980	CONCENTRATION (UG/M3) MAXIMUM QUARTERLY AVERAGE 1981	1982
POPULATION: > 2 MILLION			
NEW YORK, NY-NJ	.51	.37	.62
LOS ANGELES-LONG BEACH, CA	2.56	1.58	1.68
CHICAGO, IL	1.95 M	.89	.81
PHILADELPHIA, PA-NJ	1.26 *	1.30 *	1.57 *
DETROIT, MI	ND	.34	ND
SAN FRANCISCO-OAKLAND, CA	.73	.43	.55
WASHINGTON, DC-MD-VA	.69 M	.48 M	.71
DALLAS-FORT WORTH, TX	.67	.86	.71
HOUSTON, TX	.63	.75	.25
BOSTON, MA	.57	.37	1.08
NASSAU-SUFFOLK, NY	ND	ND	.72
ST. LOUIS, MO-IL	2.97 M *	7.27 M *	3.81 *
PITTSBURGH, PA	.58	.41	.41

M = REPRESENTS MONTHLY COMPOSITE DATA
Q = REPRESENTS QUARTERLY COMPOSITE DATA
ND = NO DATA
* = This level reflects the impact of industrial sources

TABLE 4-8

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 11/10/83 LEAD CONCENTRATION BY SMSA POPULATION RANGE PAGE NO: 2

STANDARD METROPOLITAN STATISTICAL AREA	LEAD HIGHEST 1980	CONCENTRATION (UG/M3) MAXIMUM QUARTERLY AVERAGE 1981	1982
POPULATION: > 2 MILLION (CONT)			
BALTIMORE,MD	1.11	.61 M	.86
- MINNEAPOLIS-ST. PAUL, MN-WI	3.04 *	3.11 *	7.97 *-
ATLANTA, GA	.68	.40	.59
TOTAL SMSA'S > 2 MILLION : 16			

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TABLE 4-8

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 11/10/83 LEAD CONCENTRATION BY SMSA POPULATION RANGE PAGE NO: 3

STANDARD METROPOLITAN STATISTICAL AREA	LEAD HIGHEST 1980	CONCENTRATION (UG/M3) MAXIMUM QUARTERLY AVERAGE 1981	1982
POPULATION: 1 - 2 MILLION			
NEWARK, NJ	.54	.53	.91
ANAHEIM-SANTA ANA-GARDEN GROVE, CA	1.52	.97	.92
CLEVELAND, OH	.48	.56	.42 M
SAN DIEGO, CA	1.50	.90	.81
MIAMI, FL	1.10	.88	1.51 *
DENVER-BOULDER, CO	1.53 M	1.03 M	.52
SEATTLE-EVERETT, WA	.85	.52	.82 M
TAMPA-ST. PETERSBURG, FL	1.09	.68	1.10
RIVERSIDE-SAN BERNARDINO-ONTARIO, CA	1.46	1.00	.65
PHOENIX, AZ	1.49	1.39	1.24
CINCINNATI, OH-KY-IN	.85	.37 M	.51 M
MILWAUKEE, WI	.49	.36	.38
KANSAS CITY, MO-KS	.38	.43	.28

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TABLE 4-8

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 11/10/83 LEAD CONCENTRATION BY SMSA POPULATION RANGE PAGE NO: 4

STANDARD METROPOLITAN STATISTICAL AREA	LEAD CONCENTRATION (UG/M3) HIGHEST MAXIMUM QUARTERLY AVERAGE 1980	1981	1982
POPULATION: 1 - 2 MILLION (CONT)			
SAN JOSE, CA	.94	.67	.97
BUFFALO, NY	.41	.38	.85
PORTLAND, OR-WA	.63	.58	1.63
NEW ORLEANS, LA	.36	.25	.23
INDIANAPOLIS, IN	.63	.42	.49
COLUMBUS, OH	.44	.41	.66 M
SAN JUAN, PR	1.06	1.02	1.69
SAN ANTONIO, TX	.79	.76	.72
FORT LAUDERDALE-HOLLYWOOD, FL	.35	.25	.74
SACRAMENTO, CA	.60	.62	.55

TOTAL SMSA'S 1 - 2 MILLION : 23

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ND = NO DATA

TABLE 4-8

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 11/10/83 LEAD CONCENTRATION BY SMSA POPULATION RANGE PAGE NO: 5

STANDARD METROPOLITAN STATISTICAL AREA	LEAD HIGHEST 1980	CONCENTRATION (UG/M3) MAXIMUM QUARTERLY AVERAGE 1981	1982
POPULATION: .5 - 1 MILLION			
ROCHESTER, NY	.39	.29	.26
SALT LAKE CITY-OGDEN, UT	ND	ND	ND
PROVIDENCE-WARWICK-PAWTUCKET, RI-MA	1.16	.63	1.11
MEMPHIS, TN-AR-MS	.50	.54	1.30
LOUISVILLE, KY-IN	2.52 M	.75 M	1.16 M
NASHVILLE-DAVIDSON, TN	.74	.54	1.00
BIRMINGHAM, AL	ND	2.30 *	3.82 *
OKLAHOMA CITY, OK	.32	.37	.41
DAYTON, OH	.55	.33	.73 M
GREENSBORO-WINSTON-SALEM-HIGH POINT, NC	.50	.30	.41
NORFOLK-VIRGINIA BEACH-PORTSMOUTH, VA-NC	.56	.23	.33
ALBANY-SCHENECTADY-TROY, NY	.25	.39	.05
TOLEDO, OH-MI	.18	.19	.21

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TABLE 4-8

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 11/10/83 LEAD CONCENTRATION BY SMSA POPULATION RANGE PAGE NO: 6

STANDARD METROPOLITAN STATISTICAL AREA	LEAD HIGHEST 1980	CONCENTRATION (UG/M3) MAXIMUM QUARTERLY AVERAGE 1981	1982
POPULATION: .5 - 1 MILLION (CONT)			
HONOLULU, HI	.41	.25	.21
JACKSONVILLE, FL	.23	1.42	1.72
HARTFORD, CT	ND	.48	.62 M
ORLANDO, FL	ND	.43	.36
TULSA, OK	ND	ND	.48
AKRON, OH	.38	.21	.22 M
GARY-HAMMOND-EAST CHICAGO, IN	1.04	1.09	1.72
SYRACUSE, NY	.43	.32	.25
NORTHEAST PENNSYLVANIA	1.06	.45	.56
CHARLOTTE-GASTONIA, NC	ND	.32	.39
ALLENTOWN-BETHLEHEM-EASTON, PA-NJ	.65	.34	.52
RICHMOND, VA	ND	ND	.26
GRAND RAPIDS, MI	ND	ND	ND

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REPORT DATE 11/10/83 LEAD CONCENTRATION BY SMSA POPULATION RANGE PAGE NO: 7

STANDARD METROPOLITAN STATISTICAL AREA	LEAD HIGHEST 1980	CONCENTRATION (UG/M3) MAXIMUM QUARTERLY AVERAGE 1981	1982
POPULATION: .5 - 1 MILLION (CONT)			
NEW BRUNSWICK-PERTH AMBOY-SAYREVILLE, NJ	ND	ND	ND
WEST PALM BEACH-BOCA RATON, FL	ND	.51	.31
OMAHA, NE-IA	.81	.97	1.59
GREENVILLE-SPARTANBURG, SC	.70	.55	.79
JERSEY CITY, NJ	.61	.49	.71
AUSTIN, TX	.48	.67	ND
YOUNGSTOWN-WARREN, OH	.40	.27	.24
TUCSON, AZ	.82	.52	.58
RALEIGH-DURHAM, NC	.71	.33	.47
SPRINGFIELD-CHICOPEE-HOLYOKE, MA-CT	1.04	.30	1.14
OXNARD-SIMI VALLEY-VENTURA, CA	.53	.67	.46
WILMINGTON, DE-NJ-MD	.76	.40	1.24
FLINT, MI	.15	.17	.15

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STANDARD METROPOLITAN STATISTICAL AREA	LEAD CONCENTRATION (UG/M3) HIGHEST MAXIMUM QUARTERLY AVERAGE 1980	1981	1982
POPULATION: .5 - 1 MILLION (CONT)			
FRESNO, CA	1.47	1.13	.87
LONG BRANCH-ASBURY PARK, NJ	ND	ND	ND

TOTAL SMSA'S .5 - 1 MILLION : 41

M = REPRESENTS MONTHLY COMPOSITE DATA
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